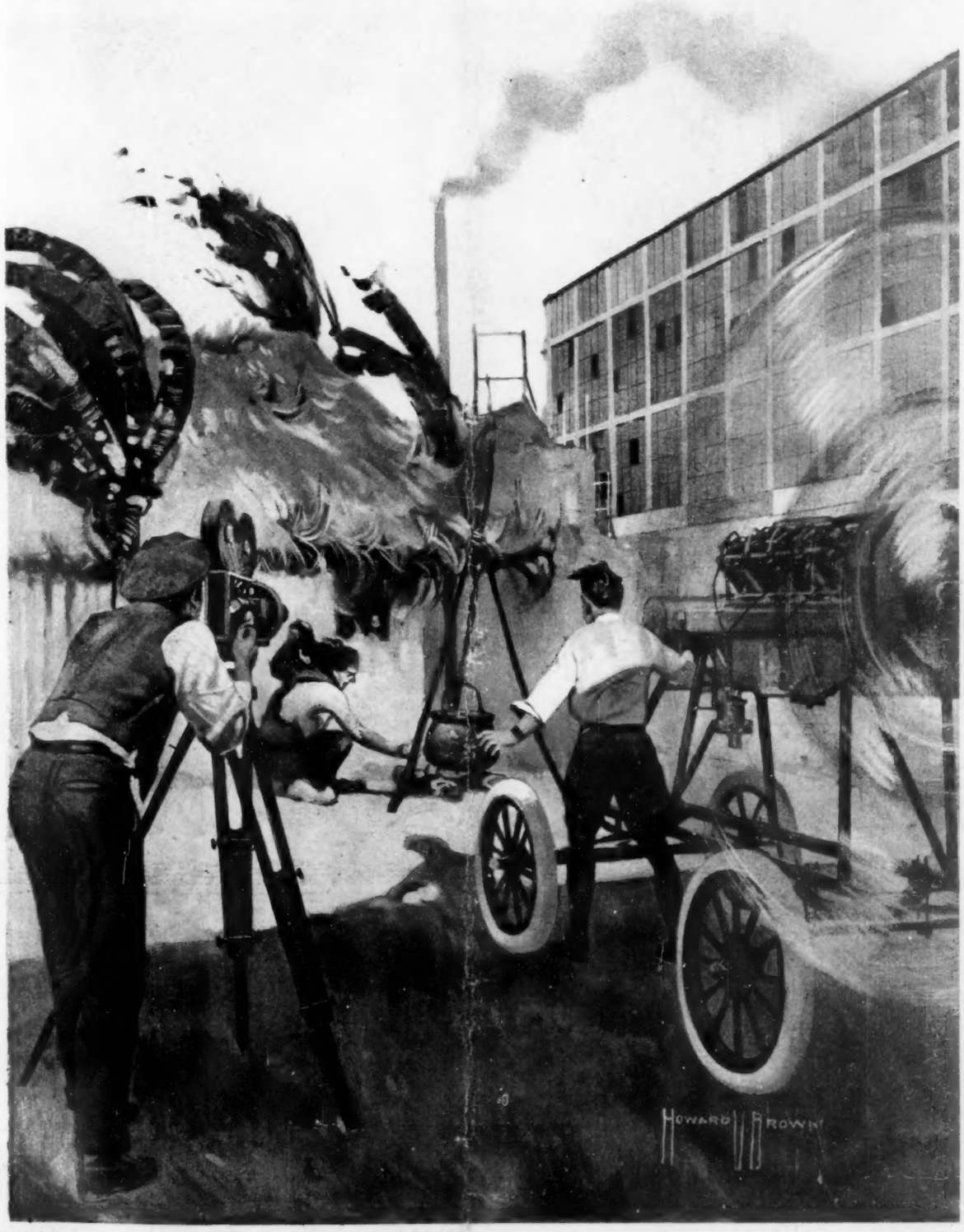
IN THIS ISSUE:

CANADA'S NIAGARA DEVELOPMENT
INSECT RAVAGES IN OUR FORESTS

# SCIENTIFIC AMERICAN

*A Weekly Review of Progress in*

INDUSTRY · SCIENCE · INVENTION · MECHANICS




WIND STORMS MADE TO ORDER IN THE WORLD OF MAKE BELIEVE.—[See page 47]

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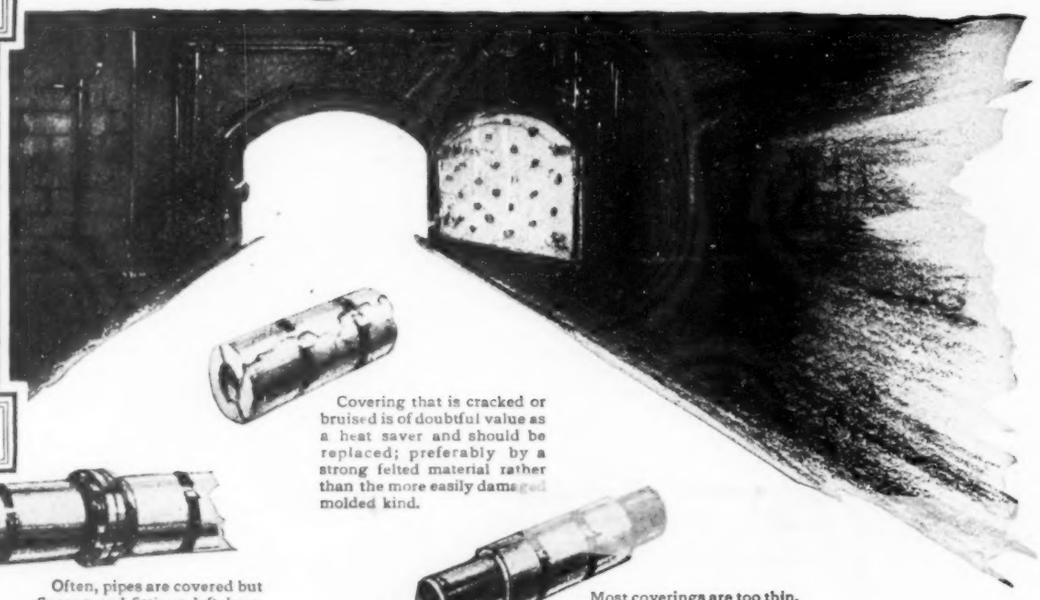
# Six ways to tell how your heat is wasted

TO encourage fuel Saving we have thought it helpful to show some of the ways that heat is lost or wasted and how such losses can be located.

The common causes for heat loss are not deeply hidden. On the contrary, they are evident to anyone who will look for them.

If you find any one of the conditions below in your system, you can without a doubt be helped by Johns-Manville Insulation Service.

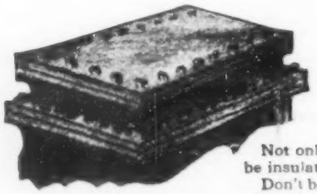


Covering that is cracked or bruised is of doubtful value as a heat saver and should be replaced; preferably by a strong felted material rather than the more easily damaged molded kind.

Often, pipes are covered but flanges and fittings left bare. Very wasteful. More fuel is wasted by leaving one pair of flanges bare than if a whole foot of the pipe itself were left uncovered.

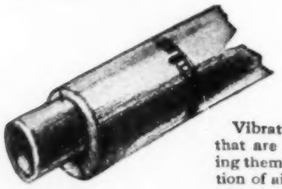
Most coverings are too thin. You cover pipes to save heat. Why not save all that is possible by using proper thickness—instead of accepting the partial saving of thin inadequate materials.

Twenty-five feet of average size bare pipe carrying steam at a medium pressure wastes 14 tons of coal a year. In the face of this fact uncovered pipes are inexcusable.



Not only pipes but every hot surface must be insulated to secure maximum fuel savings.

Don't be content with saving heat loss from pipes alone—find every hot surface and have it properly insulated.



Vibration wears away materials that are structurally weak causing them to sag, allowing circulation of air between covering and pipe, thus reducing their effective thickness and insulating value. Moral: Be sure that the material you use has more than heat-saving value—that it has long life as well—preferably a *felted* rather than a *molded* material.

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

*Through—*

## Asbestos

**and its allied products**

INSULATION
*that keeps the heat where it belongs*
CEMENTS
*that make boiler walls leak-proof*
ROOFINGS
*that cut down fire risks*
PACKINGS
*that save power waste*
LININGS
*that make brakes safe*
FIRE PREVENTION PRODUCTS

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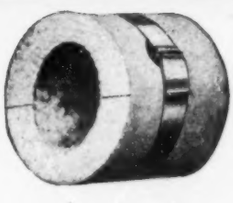
***Asbestocel***

For hot water and low pressure steam lines. Note that the corrugations run around the pipe, not along its length. This effects a marked increase in efficiency.

***Asbesto-Sponge Felt***

The most efficient commercial insulation known, and the most durable, because felted instead of molded, hence most economical.



***85% Magnesia***

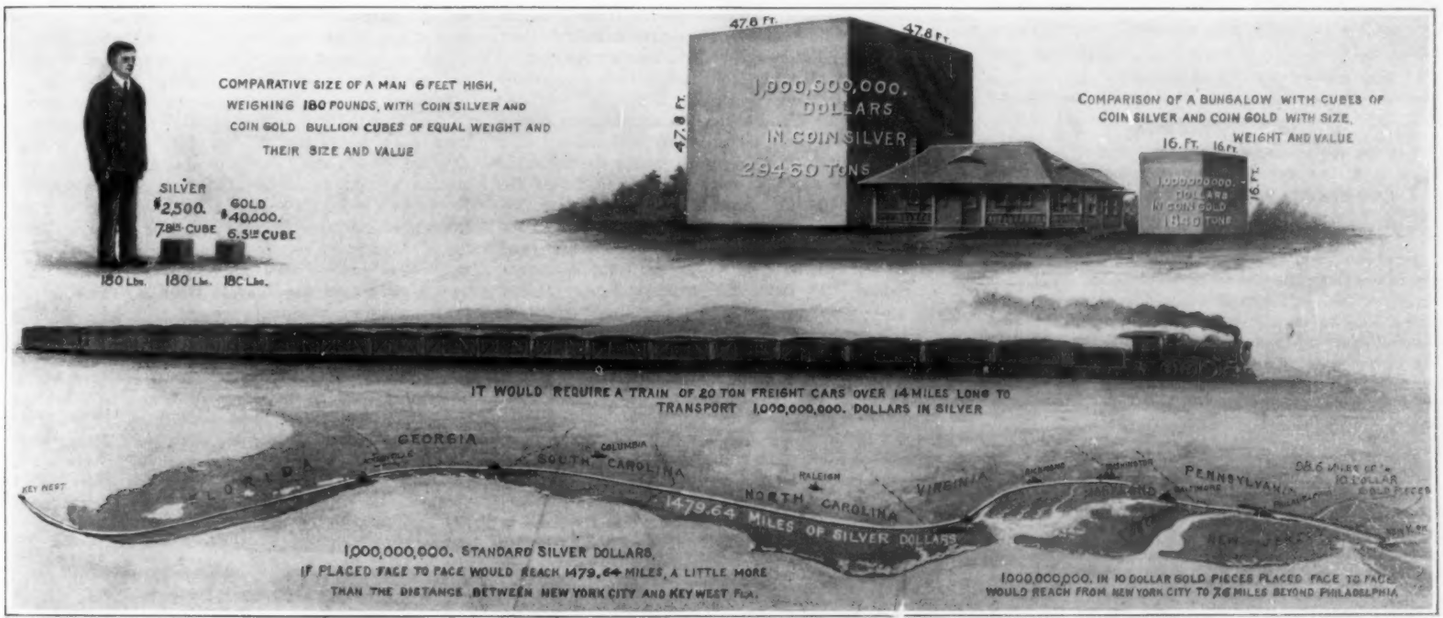
Johns-Manville 85% Magnesia, the most durable and efficient insulation of the molded type.

SEVENTY-SEVENTH YEAR

# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXIV. NUMBER 3 ] NEW YORK, JANUARY 15, 1921 [ 15 CENTS A COPY 20 CENTS IN CANADA


COMPARATIVE SIZE OF A MAN 6 FEET HIGH, WEIGHING 180 POUNDS, WITH COIN SILVER AND COIN GOLD BULLION CUBES OF EQUAL WEIGHT AND THEIR SIZE AND VALUE
SILVER $2,500. 7.85 CUBE
GOLD $40,000. 6.51 CUBE
180 Lbs. 180 Lbs. 180 Lbs.
47.8 Ft.
47.8 Ft.
47.8 Ft.
1,000,000,000. DOLLARS IN COIN SILVER 29430 TONS
COMPARISON OF A BUNGALOW WITH CUBES OF COIN SILVER AND COIN GOLD WITH SIZE, WEIGHT AND VALUE
16. Ft. 16 Ft.
16 Ft.
1,000,000,000. DOLLARS IN COIN GOLD 1860 TONS
IT WOULD REQUIRE A TRAIN OF 20 TON FREIGHT CARS OVER 14 MILES LONG TO TRANSPORT 1,000,000,000. DOLLARS IN SILVER
KEY WEST
GEORGIA
SOUTH CAROLINA
COLUMBIA
RALEIGH
NORTH CAROLINA
VIRGINIA
RICHMOND
WASHINGTON
PENNSYLVANIA
BALTIMORE
PHILADELPHIA
1479.64 MILES OF SILVER DOLLARS
1,000,000,000. STANDARD SILVER DOLLARS, IF PLACED FACE TO FACE WOULD REACH 1479.64 MILES, A LITTLE MORE THAN THE DISTANCE BETWEEN NEW YORK CITY AND KEY WEST FLA.
1,000,000,000. IN 10 DOLLAR GOLD PIECES PLACED FACE TO FACE WOULD REACH FROM NEW YORK CITY TO 26 MILES BEYOND PHILADELPHIA

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**A few attempts to demonstrate graphically the magnitude of a billion dollars**

## A Billion Dollars

NO statement of national expenditures or national indebtedness is complete, these days, that does not deal with billions in such a manner as to lead to the inference that a mere matter of hundred millions is too much of a bagatelle for any rational human being to concern himself with. Yet it is to be doubted whether the average rational human being who is thus learning to talk in terms of billions has really acquired the ability to think in billions, at least to any extent enabling him clearly to visualize to himself just what a billion dollars means.

Our artist has tried to look at this matter of a billion dollars from several viewpoints, and to draw a picture that shall give some inkling of what a vast quantity this number really represents. As a starting point he asks us to consider the relative specific weights of the human organism, of coin gold, and of coin silver. Coin gold and coin silver, it should be made clear, are not pure metallic elements; the former is alloyed with a small percentage of silver, the latter with no less than ten per cent of copper. With this understanding, we are shown that a cube of coin silver weighing the 180 pounds which the statistician ordinarily attributes to the healthy adult male, would come considerably short of being knee-high to this healthy adult male, and would be valued at $2,500; while the same weight of gold would make a cube of considerably smaller size but of sixteen times the value.

With these as units to work from, we find that a billion dollars in coin metal would make a wholly respectable figure alongside the average bungalow. The gold, if we had it in actual coin rather than in a single cubical piece as illustrated, it might be possible to stow away in the house—the latter might not be 16 feet high but it would probably be more than 16 feet square. The silver, however, would be an entirely different proposition. To get a value one billion times that of the familiar cart-wheel of commerce we should have to pile up the white metal in a cube nearly fifty feet on a side—so that the bungalow, or even an altogether more elaborate mansion, would be completely thrown in the shade.

The case would be far worse if it became necessary for us to transport this amount of silver bullion. The train which we would require for this purpose would be made up, on the face of the figures, of 1,473 cars each carrying twenty tons of the metal. Our artist tells us that this train would fill 14 miles of track—those who possess sufficient curiosity may perform a simple division to find out how long he estimates the single freight car to be. Or if we felt that this disposition of our billion dollars did not make a sufficient show, we might string the coins out, face to face, along the Atlantic seaboard. We should then find that we had enough of them to make a silver facing for the entire railroad route from New York to Key West; while even if we used the far more valuable and far less bulky gold dollar, we could run the yellow streak well past Philadelphia.

For the information of those who are sufficiently curious to desire to check up the artist, we may say that coin silver as defined by the current United States coinage regulations is valued at $13.92 per pound of 2.63 cubic inches; while its running mate in the circulation of the country is worth $223.20 per pound of 1.54 cubic inches.

## A New Airplane Wing

IT is claimed for the new Handley-Page airplane wing that by its use landing speeds far slower than at present will be possible, or, on the other hand, greater loads can be carried on higher speeds obtained with the same horsepower. In tests it was shown that landing could be safely accomplished at speeds of 36 to 38 miles.

According to a published description of the wing, "it has a much greater lift for every square foot of its surface compared with an ordinary wing. . . . The construction consists in having slots right through the planes, connecting the lower and the upper surfaces, and to the uninitiated it would appear that these slots, allowing the air to escape from the under to the upper surface of the wing, took away all the lift . . . the reverse is exactly the case. The slots in the wing virtually convert a single wing into a number of wings and increase the lifting power of the wing two or three times as much as would be possible in the ordinary construction."

Because also of the safety now attainable by flying at much slower speeds a great advance has been made, it is claimed, toward hovering, and "owing to their smaller size the wings can be built much more stoutly without increasing the weight, so that the all-metal wings become much more possible commercially. Beyond this, with the high lifting capacity of these wings it is possible to fly more efficiently at full speed." A complete description of this new wing appears in the SCIENTIFIC AMERICAN MONTHLY for January, 1921, together with photographs and drawings.

## Bridge Building in China

A CABLEGRAM from Commercial Attaché Julean Arnold, dated at Peking, China, November 27, 1920, reports that the Ministry of Communications is calling for bids for a new bridge over the Yellow River (Hwang-ho) on the Peking-Hankow Railway, to replace the present bridge, which has been much criticized as not being of sufficient strength to carry properly the motive power that is being used. The present bridge, which is by far the longest one on this line, is 9,875 feet in length, about 11 feet above high water, partly through trusses and partly deck girder construction, all supported on very elaborately placed screw piling. One-half of the superstructure was fabricated in Belgium and the other half in France, and the floor system is all of the stringer type with the openings filled in with metal plates.

It is understood that the specifications for the new bridge will call for a permissible loading of "Cooper E-50." The length of the new bridge will approximate 10,000 feet and will probably cost between $15,000,000 and $20,000,000. The Ministry of Communications reports that the specifications will be ready soon.

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# SCIENTIFIC AMERICAN

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*The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.*

*The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.*

## "Ship Mindedness"

SO far as we know, "ship-mindedness" is a new word, but excellent for its purpose. It was used recently by the chairman of the Shipping Board in referring to the loss of interest in the sea and things of the sea by the citizens of this country: "Unfortunately, in the years devoted to the development of our railroads and other overland means of communication, we lost our ship-mindedness and learned to lean heavily on ships other than our own in the over-seas carrying trade." The period of the development of our railroads in its more active form followed the Civil War, and the Civil War saw the close of the famous clipper-ship era, during which enthusiasm for the sea and ships was a distinguishing national characteristic.

The ship-mindedness of the clipper-ship era was a fine spirit compounded of sportsmanship, romance, and high commercial adventure. Those were great days for ships and sailormen, and such was the speed of the one and the bold seamanship of the other, that there were no ships afloat in the fifties that could compete in speed with the shapely craft that were fashioned on our northern coasts; and where could you find men that carried their canvas so daringly and with such apparent contempt for wind and weather as the Yankee skippers of New England?

The keenest contests for the America's Cup never excite a more absorbing interest and enthusiasm than that with which our forefathers followed the exploits and compared the speeds of the famous clipper ships of sixty years ago. Nor was any form of investment more popular than that of shares in some vessel built for the trade to California and the Orient. And not alone the daily papers of the seaboard cities, but the press of the far interior was proud to record that this or that flying beauty had reeled off so many miles in the twenty-four hours or had cut the time from New York to San Francisco by so many days.

Yes, there was ship-mindedness in those days. And there was abundant cause for enthusiasm, as those who are familiar with the marvelous sailing records of that time will tell you. The most famous ships were not what would be called large today, running, in fact, from 1,000 to 2,000 tons register. But what marvels of speed they were! Models of the best of them are still to be seen in some of the old-established shipping offices, or preserved as priceless treasures in the homes of some of our retired ship masters. The underbody of the clipper was as different from the hull of the square-rigged or fore-and-aft merchantmen of today as the "Resolute" and the "Shamrock" are from an ancient North River trading sloop; for the fastest of these craft compare favorably in the fineness and sweetness of their line with the modern racing yacht. Some of the most successful were built according to the recently formulated waveline theory of those days, and they show a long, keen, hollow bow; great deadrise; a bilge round as a barrel; and a long, easy run.

The sailplan was laid out on a daring scale, and the spars and standing and running gear were proportioned to stand the hard driving for which the Yankee skippers were famous. Consider the sailplan of the "Great Republic," built in 1853, and the largest of the clipper ships. On a length of 335 feet, the height from deck to truck was 240 feet, and the length of the mainyard 120 feet. The fore and main rigging and backstays were 12½-inch, four-strand Russian hemp rope, and the dimensions throughout the ship were on a similar scale. As for the sustained speed of these ships, it was simply marvelous and is explained by their sweetly turned hulls, the enormous spread of canvas, and the big inducements, in the way of enhanced professional reputation and a cash bonus, for the captains to make rapid voyages.

These men were no fair weather sailors. It is a well authenticated fact that they sought rather than avoided the heavy gales, should these happen to be favorable to their course, and the results are recorded in their log books. There was the "Sovereign of the Seas," of 2,400 tons' register, which in 1853, when running before strong westerly gales on a voyage from Honolulu to New York, sailed on four successive days 396 miles, 311 miles, 411 miles and 360 miles, which works out at an average speed of 15½ knots for four consecutive days. Consider the feat of the "Lightning," of 2,084 tons, which in 1854, on her maiden voyage from Boston to Liverpool, ran into a heavy southerly gale, during which the skipper, on March 11th makes the following entry: "Hove the log several times and found the ship going through the water at the rate of 18 to 18½ knots; lee rail under water, and rigging slack. Distance run in twenty-four hours 436 miles." This represents an average of 18¼ knots. It was twenty-five years before the steamship "Arizona," an Atlantic greyhound of her day, made 18 knots on her trial trip.

"Ship-mindedness." We shall not see again quite the sporting ship-mindedness of the middle years of the last century. The 25-knot speed of the "Lusitania" and the 54,000-ton displacement of the "Leviathan" represent a limit of speed and size which will not be surpassed probably for a decade to come. But there is a more serious ship-mindedness, which recognizes the present conditions as affording a great opportunity for the United States to take and maintain once more a leading position on the trade routes and in the ports of the world. In a peaceful sense, and with all friendly feeling toward other great maritime nations, we can say that in great part our future lies upon the sea.

## Recent Milestones in American Aviation

IN our recent review of progress in aviation during the past year, it was possible to deal with the subject only in a broad way, without going much into details. The fact that commercial aviation, because of a lack of aerial laws, adequate landing fields and a definite government policy, did not get very far during the year must not shut our eyes to the fact that our American aircraft have advanced to a state of efficiency which is full of promise for the future; and the Manufacturers' Aircraft Association is fully justified in claiming that decreased production and the general contraction in industry are offset by the encouraging records of performance made by American machines.

In the matter of endurance, machines both for the Army and Navy have shown really remarkable efficiency. As evidence of this, take note of the trip of the "NC-4" from New York down the Atlantic and Gulf coasts and up the Mississippi River to Cairo, Illinois, and return, a round trip of 7,740 nautical miles, during which three of the four Packard-Liberty engines operated without trouble for 118 hours and the fourth for more than 82 hours. Even more remarkable as an evidence of efficiency and endurance was the trip of four Gallaudet two-seater machines, each powered with a single Liberty motor, from New York to Nome, Alaska, and return, a total distance of 9,000 miles, which was covered "without a motor missing fire or other accident serious enough to delay the party." Another long-distance trip remarkable for the speed achieved was that of a Boeing "D.H.-4-B" plane, which was flown from Camp Lewis, Washington, to San Diego, California, a distance of 1,160 miles, most of it over mountain ranges 7,000 feet high, at an average speed of 120 miles per hour.

The work being done by the Government Air Mail is too little understood by the American public. Thus, how many of us know that during last year this service, operating between New York and Washington and between New York, Cleveland, Chicago, Omaha, Salt Lake City and San Francisco, carried approximately one hundred million letters at ordinary postage rates. Again, as we go about our daily duties, do we realize that every day this service has some 35 air mail planes in the air and that they are flying a total in round trips, daily, of about 8,000 miles. As demonstrating the possibilities of time saving it is sufficient to instance the day on which a plane carried 16,000 letters from Chicago to New York in five hours and fifty-six minutes.

A severe test of efficiency is that of climbing with heavy load, and here we note that an Orenco machine carried four persons to a height of 17,150 feet and that a Dayton-Wright coupé carrid the same number of people to a height of 19,710 feet. The world's record for height in a single-seater was brought to America by a Packard-Lepere biplane, which reached an official altitude of 33,000 feet. Nor must we forget the feat of one of our army fliers, Donald Hudson, who in a Curtiss "Wasp," crossed the Andes at an altitude of 30,000 feet above sea level.

Nothing will popularize travel by air so quickly as to prove to the public that it is as safe as travel by land and sea. In this respect there has been a great advance, due to two notable achievements, designed to eliminate risks from fire and from forced landings. In the first case, Air Service officials, at Curtiss Field, saw a plane set afire in mid air and fly unharmed until the gasoline which had been poured over it had burned away. On another occasion U. S. Army officials conducted successful experiments with a reversible propeller, stopping a plane equipped with one of these within seventy-five feet of the point where the wheels first touched the ground.

A consideration of the above highly creditable record of achievements proves that the past year has been marked by a great technical advance in the art. The plane is ready for the public; all it asks is for proper laws, adequate landing fields, continued governmental encouragement, and sufficient financial support by the public for the establishment of new routes of travel and the improvement of the few that have been put in service.

## Two Gigantic Waterpower Developments

THE present high cost of fuel is not an unmitigated evil; for under the spur of necessity we are being driven to make use of other natural sources of heat and power than coal and oil, on a scale that otherwise might not have been attempted for decades to come. We have particularly in mind two power developments, one in England, and the other in the United States, each of which will be far greater in output than any waterpower plant at present in existence or contemplated. Of these, the British scheme is the more original, since it contemplates the use of the tidal power of the estuary of the Severn River. That the scheme is not visionary is proved by the fact that the investigations and plans have been drawn up under the British Ministry of Transport. Briefly stated, a dam 2½ miles long will be thrown across the mouth of the Severn and in this dam will be installed hydroelectric turbines of a total of one million horsepower. The total fall of tide is thirty feet, and to secure a continual supply of current, 500,000 horsepower will be delivered direct to the line and the other 500,000 horsepower will be utilized in pumping water to a high level reservoir, which will supply hydroelectric turbines during the five hours in which the stage of the tide will prevent operation of the turbine plant in the main dam.

The American scheme contemplates the building of a dam 500 feet in height, which will impound 93 per cent of the flow of the Colorado River in a storage basin over 200 miles in length, impounding more than forty million acre-feet of water. The total hydroelectric development as thus provided for will be over four million horsepower. It is contemplated to distribute this power over country covered by a radius of 500 miles, and embracing eight of the Western States. The gross hydraulic head of 3,300 feet will be developed at four separate power stations, located along the course of the river. The scheme has been under investigation for several years, and the application recently presented to the Federal Power Commission has been accepted.

## Naval and Merchant Marine

**The German Battleship "Ostfriesland."** — A naval officer, writing of the ex-German battleship "Ostfriesland," speaks favorably of the watertight construction of each separate fire and engine room on this vessel, which is now at the Brooklyn Navy Yard. He thinks it is doubtful if a single torpedo or mine, or even two, would sink the ship. There are seventeen watertight subdivisions from forward aft, and within the engineering spaces these compartments are subdivided by two fore-and-aft bulkheads into three separate watertight compartments. There are no doors through the bulkheads below water line.

**Torpedo Inefficiency.**—It seems that in the earlier months of the war there were many cases in which British submarine attacks on warships failed because of the erratic running of torpedoes. One submarine officer of distinction has stated that in the first six months of the year, the British "missed bagging five large and seven small German war vessels in consequence of torpedoes running badly." It is thought that the fault was due to inefficient personnel who were not properly conversant with torpedo adjustments. Subsesuently, after more thorough training of torpedo specialists, the difficulty disappeared.

**Daniels Now Favors Disarmament.** — It is gratifying to note that Secretary Daniels has dropped the club of a super-navy, with which he fatuously imagined he could drive unwilling nations into the League of Nations, and has now come out in favor of an amicable discussion of a reduction of armaments by the naval powers that are most concerned. We have always regarded the call for rushing to completion the 1916 three-year program and the threat of a second three-year program as one of the most ill-timed and, in its effects, most disastrous policies ever set forth by a naval secretary. Mr. Daniels cannot do better in the closing days of his tenure of office than seek to allay the post-war suspicion and unrest which his "big navy" talk has started.

**Panama Canal Defenses.**—Plans have been drawn up for rendering the Panama Canal impregnable. These are additional to the existing plans for the mainland defenses and include the placing of several of the longest-range rifles on Taboga Island, which is located about fifteen miles off the Pacific entrance. Presumably, these guns will be of the new 16-inch pattern. At the Atlantic end there will be a system of tracks designed for the heaviest railroad artillery mounts carrying guns of large calibers with a greater range than those installed on the most powerful dreadnaughts afloat. The terrain at the Atlantic entrance is well suited to this system of mobile artillery, which can be fully screened by the dense tropical growth characteristic of this locality.

**Active Construction of Oil Tankers.** — As an evidence of the activity of our private companies and yards in the construction of shipping under the provisions of Section 23 of the Merchant Marine Act of 1920, the United States Shipping Board has published the names of seven companies which have recently applied for the construction of the following ships, the capacity of which is given in deadweight tons: For the Atlantic Coast Company, two schooners of 2,400 tons; for the Boston Maritime Corporation, taree schooners of from 1,700 to 2,400 tons; for the Luckenbach Steamship Company, a tanker of 8,800 tons; for the Standard Oil Company, five tankers ranging from 2,300 to 11,600 tons; for the Alaska Steamship Company, a 6,000-ton twin-screw cargo motor ship; for the Calvert Navigation Company, a 10,200-ton tanker; and for the Sinclair Navigation Company, two tankers of 6,900 tons deadweight.

**The Jutland Controversy.**—A disappointed British lay writer on naval topics, chagrined because his range-finding inventions were not accepted by the British Admiralty, started, after the battle of Jutland, a savage attack upon Admiral Jellicoe, who was in command. This was gleefully taken up by the enemy, and also, by certain elements among her own allies that were jealous of British sea power, and thus started the so-called Jutland controversy. The critics say Jellicoe should have dashed in and sunk the German fleet that afternoon and night; Jellicoe's defenders believe that since the fate of the allied cause hung upon the absolute control of the sea, Jellicoe was absolutely right in being content to drive the Germans back to Kiel and Wilhelmshaven and hold them there. His course was not spectacular, but it was sane strategy, as the event proved. To gain a victory with his fleet practically intact was wiser than to gain one with half his ships at the bottom of the sea, although the latter result would have been eminently pleasing, apparently, to most of his critics.

## Science

**Housing Conditions for Stock.**—The Committee on Ventilation of Farm Buildings of the American Society of Agricultural Engineers is making a study of the proper housing conditions for live stock in various parts of the United States and Canada. An article relevant to this subject, entitled "Climatic Dairy Barns," is published by Messrs. W. B. Clarkson and C. S. Witnah in the newly founded journal *Agricultural Engineering*. The writers have divided the country into four well-defined zones, based on sustained low temperatures in the winter months, and have outlined the proper type of barn in its relation to such conditions for the several zones.

**A Rat Adopted by a Cat.**—In her recently published book "Wild Creatures of Garden and Hedgerow," Miss Frances Pitt states that she gave a baby rat, still blind, feeble and very naked, to a cat whose litter had been reduced to one kitten, then 10 days old. To her surprise, the cat accepted this unusual foster child. "The rat," says Miss Pitt, "was cleaned, fed, fondled, tended and treated just like the kitten, along with which it was reared. Even after another family came to occupy the cat's attention, she remained on friendly terms with the rat and often paid him a visit. The cat in question had been a good ratter, but after the adoption ratting was done with!"

**The Seismological Service of Hungary** has resumed its work, which was partially interrupted by the war, and has published in one volume a report on the seismograph records made at Budapest during the years 1913-1919. The director, Dr. R. de Kövesligethy, states that a large amount of apparatus had been ordered from Russia in 1913, and that when the war broke out he himself was in Russia, in his capacity of secretary of the International Seismological Association, making arrangements with the late Prince Galitzine, president of the Association, for the fifth conference. When, at the end of August, 1914, he succeeded in returning to Budapest, he found the seismological observatory deserted, the whole staff having been called to the colors. One of the assistants, A. Hille, is still a prisoner of war in Siberia.

**The Radio Compass.**—The U. S. Lighthouse Service, with the aid of the Bureau of Standards, has been carrying on experiments in radio direction finding as a means of navigation in thick weather. A radio direction finder was recently installed on the tender "Tulip," and automatic wireless signaling apparatus was placed at the Sea Girt light station and on the Ambrose Channel and Fire Island light vessels. The direction finder is so arranged that the directions may be read directly on a standard magnetic compass. The automatic wireless transmitting sets are of simple design, requiring no expert knowledge in their operation and no mechanical or electrical adjustments after the installation has been completed. The use of the direction finder is also quite simple, requiring no previous knowledge of wireless telegraphy. During the preliminary tests the master of the tender, after a few minutes' instruction, was able to operate the compass without difficulty, and in a run of about 43 miles, during which he navigated his vessel entirely by the radio compass, he brought the tender within 300 feet of Fire Island light vessel, for which he was heading, with only three readings of the compass, the last being taken at a distance of about 15 miles.

**Systematic Photography of the Aurora.**—The work of Prof. Carl Störmer, in Norway, in making simultaneous photographs of the aurora at two or more stations in order to determine its exact altitude and position in space has now developed to such an extent that, during the remarkable display of March 22-23, seven stations connected by telephone were in operation: viz., Bygdö (Störmer's home), Oscarsborg, Horten, Christiania, Konigsberg, Fredrikashald and Dombaas. The distances between stations range from 26 to 89 kilometers. During the years 1911-1920 the stations at Christiania and Bygdö have made more than 300 successful pairs of simultaneous pictures, besides about 200 single pictures. Many fine photographs—single, double and triple—were secured of the aurora above mentioned. Several single photographs were made of some wonderful blue rays, which formed a "corona" of dazzling brilliancy, and which were so intense that they were photographed, with an exposure of less than a second, after the dawn had so far advanced that first-magnitude stars were barely visible. Prof. Störmer reports that preliminary measurements of his photogrammetric pictures indicate for the upper limit of the auroral rays in the recent display an altitude of the order of 500 kilometers (310 miles). No aurora had previously been photographed above about 370 kilometers.

## Automobile

**Solution for Tires.**—It is stated that bicycle tires and inner tubes of automobile tires may be made quite safe from small punctures by using a liberal amount of the following mixture: Procure 1 pound of sheet glue and dissolve it in warm water—enough to dissolve the glue only. After the glue has been dissolved add 1 quart of molasses. Remove the valve and inject this mixture—about one cupful—into a bicycle tire and a correspondingly greater amount in auto tubes, depending on their size. Replace the valve and blow up the tire. This mixture semi-hardens into an elastic jelly. This treatment will stop all leaks in a tire.

**Emergency Repair of Rim Cuts.**—Rim cuts are often given up as hopeless by the motorist, but they can be repaired in an emergency in the following manner: Drill or punch a series of holes on each side of the break at intervals of ⅜ of an inch and far enough from the edge so that they will not pull out. Lace the holes with a cord made of six strands of braided fish line, rawhide belt lacing, or any braided cord about 3/32 of an inch in diameter. Soak this lacing in paraffin or wax to make it waterproof, then thread it through the first hole, wind it around the head, through the second hole, and so on. Let six inches of the cord or lacing hang over on each end for tucking away. Finally place a blow-out patch over the lacing inside the shoe to protect the tube against injury.

**Large Export Trade in Motor Vehicles.**—That the motor vehicle manufacturers of the United States have been busily engaged in cultivating foreign markets, despite the unprecedented domestic demand for their product, is revealed in the fact that exports of passenger cars and motor trucks in the 1920 fiscal year were 158 per cent greater than the previous twelve months and nearly 75 per cent larger than in 1917, the best previous year. In the twelve months ended June 30th, last, the United States exported 115,519 passenger cars valued at $41,577,684, a total of 139,875 motor vehicles worth nearly $167,000,000. This compared with 54,212 vehicles of all classes valued at $79,086,190 shipped out of the country during the previous year and represents an increase of more than 59,000 vehicles over exports of 80,785 in 1917.

**Wireless Telephone for Automobiles.**—A compact wireless telephone set operated with current from the batteries and generator of an automobile and transmitting and receiving over an aerial wire stretched from the top of the windshield to the radiator cap, is the latest equipment provided for the modern motor car or truck. It is one of the new developments introduced at the Electrical Exposition recently held in Grand Central Palace, New York. This apparatus, exclusive of the batteries and aerial wire, is contained in a box a cubic foot in size and the weight complete is 60 pounds. The price of a double set, one carried on the automobile and the other set up at home or at the office, is $350, which is not sufficiently high to discourage anyone whose business interests were such that they had to keep in constant communication with their office or home. It is not expected that many business men will find it necessary to use an outfit of this nature, but it is comforting to know that such an outfit is available if needed. Its utility on motorboats and for military purposes is apparent.

**Cleaning Automobile Mechanism by Spraying.**—A novel method of cleaning automobiles is being installed in some of the garages. This new cleaning process, which is the product of a Chicago firm, is stated to reduce the cost of the work and also eliminates the objectionable features connected with the ordinary methods of cleaning. The apparatus used consists of a long nozzle, held by the operator, through which a mixture of air, oil and water is sprayed on the automobile frame, axles or engine at a uniform pressure of about 90 pounds per square inch. The nozzle discharges the mixture in the form of a spray, which is directed against the surface to be cleaned at an angle of about 45 degrees from a distance of 18 inches. One gallon of oil is used to about 300 gallons of water, the proper mixture being secured by regulating valves attached to a special oil tank. The mixture of oil and water is carried to the nozzle by a ¾-inch rubber hose, the stream being broken up at the nozzle by air supplied through a ½-inch nipple. The temperature of the water used is about 100° to 120° Fahr., and the oil is a light-colored gas oil or petroleum distillate having a paraffin base. The cleaning can be done inside the garage, but more conveniently outside. It is stated that by this method an automobile can be thoroughly cleaned and that no difficulty is experienced in using the process in severe winter weather, and it has been operated with entire success at zero temperature.

A panoramic view of the forebay on the ledge above the Queenston power house

# Canada's Niagara Development

## The Details of the Queenston-Chippawa Project Now Being Pushed Toward Completion

By J. F. Springer

THE difference in level between Lakes Erie and Ontario is 330 feet. The Hydroelectric Commission of Ontario proposes to utilize 305 feet of this head in developing electric power. The plant as at present conceived will have a capacity of 300,000 horsepower, this energy being developed from a flow of 10,000 second-feet. This seems to be a higher practical efficiency than has been realized by any of the other Niagara developments. According to a contemporary, the old Niagara River power plants got from 12 to 15 horsepower per second-foot; the Ontario Power Company's development on the Canadian side is in the neighborhood of 17; and the Hydraulic Power Company's development on the United States' side, about 20. The enterprise now being put through by the Hydroelectric Commission, since it will get 30 horsepower per second-foot, is 50 per cent in advance of the best of the others.

The map shows that the two most eastern of the Great Lakes overlap each other in an east-west direction. At the eastern end of the overlap, the Niagara River connects the two lakes. Niagara Falls is situated at a point on the Niagara River somewhat to the north of the middle. Naturally, the various diversions of water above the falls tend to reduce the volume passing over the ledge. The total flow of the river is estimated at 220,000 second-feet. There is an agreement between the United States and Canada, under the terms of which 56,000 second-feet are allotted for power developments. Canada has the right to 36,000 and the United States to the 20,000 balance. At the present moment, the Commission controls nearly 18,000, and the project now under construction will add 10,000. It may be seen that our Canadian friends are busy utilizing their share.

The new development is associated with the names of two towns on the Canadian side. On the south bank of the Niagara River just before it makes its great leap is the town of Chippawa. Here the Welland River joins the Niagara, after flowing in a generally eastward direction. Another name for this stream is the Chippawa River. Four and one-half miles of this river are being canalized from the Niagara River to a point near where the Michigan Central crosses. A power canal is being constructed north and northeast for a distance of nine miles. This brings us back again to the Niagara River, but below the falls. This point of junction is at Queenston. Here the power-house is being located. The whole enterprise may be termed the Queenston-Chippawa Development. In the island thus created, the (Canadian) city of Niagara Falls is situated. In fact, the power canal passes close to or through its outskirts.

A remarkable feature of the foregoing plans is the reversal of the Welland River for a distance of 4½ miles from its mouth. And not only this, but the western part of the river will no longer send its waters to the Niagara River above the falls but through the power canal to a point below them. Through the 4½ miles of the river bed, the Niagara River will send water westward to join that of the old Welland River in the power canal.

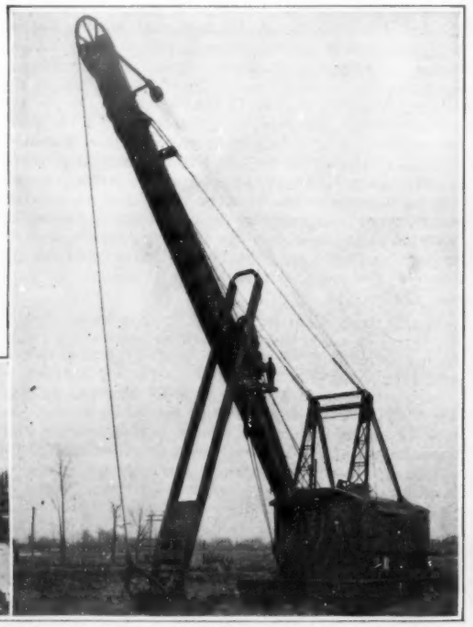
The velocities of flow in the old Welland River bed and in the power canal must naturally be adequate to carry the proper amount of water. Where the cross-section is reduced, the velocity will need to be increased. In the old river bed, where the cross-section is considerable and where less than the full complement of water is being carried, the average velocity is put at 2 feet per second. In the power canal, however, where the cross-section is never very large, the average velocity is about 6½ feet per second. Naturally, the gradient is the principal factor in controlling the velocity, though friction does play a part.

Control works will be located at the point where the old Welland River and the waters diverted from the Niagara River join to furnish the supply of power water for the power-house nine miles to the north. The difference between 330 and 305 feet is the loss in head from the theoretic ideal. Of the 25 feet, twelve are to be accounted for by the drop in level between the Niagara River and the control works, and eight by the drop in the power-canal. Then two feet are allowed for the drop in the Niagara River between the power-house and Lake Ontario. The remaining three feet are allotted to friction—one-half foot to friction in the canal and 2½ feet to friction in the penstocks.

In general, the power-canal runs through a region where, after the removal of a heavy stratum of soil, the canal is bottomed in the rock. There is, however, a notable exception to this at a point opposite the Whirlpool. Here the rock is too far down to permit its utilization for the bed of the canal. It is conjectured that this sudden deepening of the bed-rock level marks a former course of the Niagara River gorge.

The form of the bed now being excavated for the power-canal varies a good deal. There are no less than six varieties of representative cross-sections. Near the beginning of the canal, the bottom is 70 feet wide and the banks are moderate slopes. The canal is here wholly in the earth. The banks are, however, protected with a heavy rip-rap facing. Farther north, the canal is deep in the rock but has earth on each side near the top. The upper part is accordingly provided with a considerable width between the banks and moderate slopes down to lines set back somewhat from the margins of the rock. The rock portion has vertical sides. Still farther north where the earthen portion is deeper, the rock part is narrowed. At another location farther north, there is the earth section and the

(*Continued on page 55*)



*Left:* Cable-way excavator at work on the the dry-land section of the job. The carriage is hauled back and forth on the cable suspended from the two towers, which move forward on their tracks as the work progresses. *Center:* Small pilot shovel at work ahead of the giant steam shovel, claimed to be the largest in the world. *Right:* A closer sight of this huge shovel, which appears in the background of the middle view

Some of the tools, of novel design or unusual size, employed in cutting the Queenston-Chippawa power canal

## Fifth Avenue's Traffic Tower

**By Ralph Howard**

SOME months ago a mysterious tower made its appearance in the middle of Fifth Avenue, just above 42nd Street, one of New York's busiest corners. It was at once apparent that the structure was to have some connection with the business of the traffic officer, but until the system of which the tower is the mainspring was ready to go into effect the precise nature of that connection was a carefully guarded secret.

The fact is, this system involved running the traffic on Fifth Avenue in an altogether novel manner. Heretofore on trunk streets of this sort there had been no particular effort to coördinate the work of the officers at successive corners. Of course, when the traffic is cut off at Umpty-first Street, if the officer at Umpty-second has ordinary human intelligence he will make some attempt to watch the tide of vehicles backing up toward him, and to open the cross street when it reaches him. But this isn't always easy—it involves a nice judgment on the part of "cop" and drivers which is not always possible to put into play, and a coöperation between them which is not always given. And in any event, when we have three miles of a main thoroughfare jammed solid with six lines of crawling vehicles, with much heavy traffic on the intersecting streets and a great deal of turning into and out of these streets from and to the main thoroughfare, the good that can be accomplished by isolated individual effort on the part of the officers at successive crossings isn't very large.

With each crossing operated independently of others, there is bound to be a good deal of unnecessary delay. While the avenue is closed at, say, 49th Street, it is open at 48th, but to no effect because no cars can pass 49th; and when it is opened at 49th, this again is without effect because the officer at 48th selects this moment to pass the crosstown traffic which has been accumulating on his hands. Or again, the officer at 45th releases traffic on the avenue while 42nd is open to crosstown traffic; and immediately the back-wash from this blockade surges back as far as 45th, and there is complete deadlock here, with neither north-and-south nor crosstown traffic able to move. So the Police Department decided that in the interests of a maximum vehicular movement it was essential to introduce some system under which at all times the avenue should be either open to traffic throughout its length or closed in favor of the crosstown stream at every crossing.

The tower was put up to provide the necessary central control station for such a system. As a matter of fact, there are other towers, at 34th Street and other points, which relay the signals from the main tower at 42nd; but these are not really necessary, since the main tower is visible from all points between Washington Square and 59th Street. Facing north and south on this main tower are three huge lights. There is a green light to indicate that the avenue is open; a red light to show that it is closed in favor of the crosstown traffic; and a white or yellow light set between the other two, to give warning of a change.

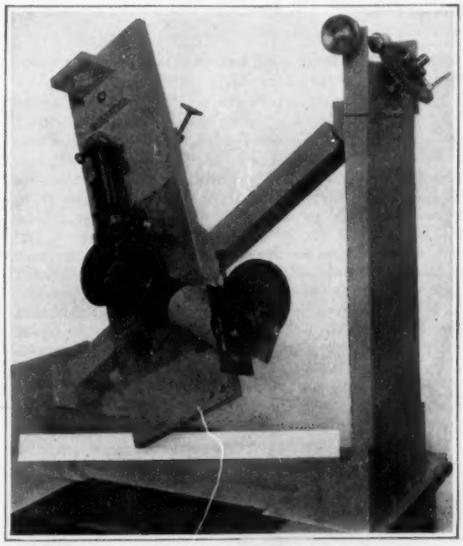
The tower is not designed to do away with the officers at the individual crossings, but merely to superintend and coördinate their work. Each officer obeys the signals from the central tower implicitly. The yellow warning which flashes for several seconds before the shift, say, from green to red, gives him time to get all north- and south-bound traffic cleared off his crossing; then when the red light finally beams out, he is all set to start the crosstown wave surging over without a second of lost time.

The responsible authority over all this of course has

(*Continued on page 57*)

1. Fifth Avenue open to traffic at 42nd St., with the pedestrians lined up waiting their turn to cross. 2. An instant after the change of signals: the last vehicle to cross 42nd St., a big sight-seeing bus, is just getting clear, and the crosstown traffic is surging across. The pedestrians get under full headway more quickly than the trolleys. 3. The traffic tower that controls the situation

**Traffic on Fifth Avenue, New York, under central direction from a single tower**



**The Bureau of Standards developed this instrument for measuring the intensity of the sun's rays**

## Sunshine and Balloon Silk

**By S. R. Winters**

THE Government desired to know the contributing factors to the aging of balloon fabrics and the deteriorating influences to which gas balloons are subject. The search for specific information on the subject gave birth to a new instrument designed by W. W. Coblentz of the National Bureau of Standards, described as a spectropyrheliometer, for measuring the component radiations of the sun. Similarly, a problem was presented for offering a substitute for colored glass to exclude ultra-violet solar rays from the interior of buildings, these rays being injurious to structures.

To study the sun seems far-fetched in its application to work-a-day problems. However, when results are translated in the tangible fact that a buff or red paint absorbs the ultra-violet and thus protects the contents of a building, the commonsense business man is willing to acknowledge that sunlight, science and a bucket of paint have something in common. Colored window glass is expensive, you say. Well, the Government scientist, who applied the unwieldy name "spectropyrheliometer" to a simple device, suggests that the windows be placed on the north side of a building, fixing them low, so that the direct sunlight concentrates on the floor. This, and other expedients, so it is claimed, would save thousands of dollars on glazing alone. Another effective method, determined by government tests, is that of varnishing common window glass with dilute asphaltum varnish in absorbing the ultra-violet rays.

The new instrument for following the sun is mounted upon a polar axis, thus avoiding the absorption which takes place in a heliostat mirror. As illustrated in the photograph, this axis rests in a wooden frame. Such an arrangement permits of the projection of the solar image directly upon the slit by means of a planocylindric quartz lens, 6 centimeters in diameter and 18 centimeters focal length. A novel feature of the device for studying sun rays is the cylindrical lens which facilitates its operation without clockwork, the axis being parallel with the slit. The reflection from the sun, focused lengthwise on the slit, travels slowly, which fact offers opportunity for a series of readings without resetting. Displacing the center line of the solar image 1 centimeter along the slit causes a variation of only 1 to 2 per cent in the measurement of the sun rays. The image was accurately adjusted to within 1 millimeter lengthwise on the slit.

Slightly turn the worm gear, and it is easy to follow the sun. This gear is fastened to the polar axis by a screw which has a handle. A slight twist of the screw releases the gear for speedy hand setting of the spectroscope in correct ascension. The declination setting is accomplished by a screw clamp, the fine adjustment of which is obtained by another screw, working in a nut attached in a pivot to the board supporting the spectroscope. A counterweight is an accessory of the equipment, and when weights are used there is no vibration from the wind or from the manipulation of the worm gear. The apparatus was located on a lawn when making solar-radiation-intensity measurements, the weights on the cross boards insuring steadiness in operating the mechanism.

The spectrum was produced by use of a quartz prism and two plano-convex quartz lenses, 6 centimeters in diameter and 18 centimeters focal length. These were mounted upon an aluminum plate, attached to the board,

(*Continued on page 58*)

# The Romance of Invention—XIX

## An Inventor of Fighting Machines and His Work in Adding to the Efficiency of Navies

By C. H. Claudy

REAR ADMIRAL BRADLEY A. FISKE has stated emphatically that no man deserves the title of "father of the new navy." But no man can stand on the deck of a battleship, look about the modern mighty fighting machine and see more inventions, devices and scientific and mechanical adaptations that had their origin in the brain of the observer, than can he. If he be not "father" to the mechanics of a fighting ship, he may safely be denominated one of the principal weavers of the pattern which has made the United States floating mechanism of destruction the most highly developed in the world.

Admiral Fiske was an inventor from boyhood. Among his early recollections is an idea for distilling sea water, which he imagined might have been highly useful to Robinson Crusoe, in which the vapor of boiling water was caught in an inverted cone with its rim turned inward to form a circular cup, the outside being chilled by either air or water. Another was a pair of separable sleeve links, to avoid the annoyance of inserting the ordinary links, which were later brought out commercially and proved a great success—indeed, one buys them now. It was another's patent, but Admiral Fiske recalls his invention of the same idea years before it was exploited commercially.

With more patents to his credit than he could count for the SCIENTIFIC AMERICAN, and having seen some of his more basic ideas adopted all over the world, Admiral Fiske can surely lay claim to being one of the successful members of the tribe of those who create the new and useful from their powers of thought and imagination. Financially, Admiral Fiske protests that he doubts if he has more than "broken even" on the game, first, because many of his more important devices have been presented to the Navy in the service of which he devised them, and second, because he has spent so much of the proceeds of other inventions in developing still others.

"And yet," he says, "there have been times when an invention made me some money which was most welcome, as in the case of an automatic lead pencil, which brought me a check for a thousand dollars in royalties when I needed it most. The fact that the sales of that highly successful automatic lead pencil dropped off to nothing shortly thereafter, for the very good reason that when the pencil was dropped the lead in it invariably broke, has nothing to do with the need for that thousand dollars nor the welcome it received."

Admiral Fiske has so many naval ideas to his credit and has seen so much of his thought and originality incorporated in the navy with which he, literally, grew up, that it is difficult to select the most important for mention. But the two which perhaps are the greatest monuments to his ability are his system of adapting telescope sights to navy guns, and the invention of the torpedo plane.

Admiral Fiske himself refers to his invention of the application of the telescope sight to large and small navy guns as "the most important idea I had ever had." There seems to be no question whatever that it at one stroke revolutionized gun-fire and raised naval gunnery from the lowly rank of a, literally, hit or miss piece of guess work, to an exact science. It is strange to relate that this invention came into being through the use, by the inventor, of another invention of his own. The Fiske range finder, which was, at the time it was first used, the most successful device produced for measuring ranges up to three thousand yards, the maximum effective range in 1890 (!) was idle during a cessation of practice firing on the "Baltimore." Admiral Fiske (he was not Admiral then) was looking through one of the telescopes of the range finder and watching the cross hairs of the instrument slide up and down on some sailing vessels, as they and the "Baltimore" dipped and rolled in a quiet sea. Right then the idea came to him that if all the guns on one broadside were elevated at the same angle from the deck while a telescope on deck was so depressed that the vertical angle between it and that of the guns was equal to the elevation of the guns necessary for the range, a broadside could be fired with so great an accuracy that every shot would register on the target at once. Admiral Fiske's idea was to "lay" the guns parallel with the deck, or at the same angle above it, depress the telescope to the correct angle as shown on a dial, find the target on the cross hairs with the roll of the ship, and then fire all guns together by electricity, and make them all hit at once.

This idea was patented, and the single claim which it carried is given herewith, because it in a way underlies all the modern practices of naval gunnery.

"The method of pointing a gun located on a rolling, heeling or vibrating platform, which consists in adjusting a telescope, also located on said platform, and movable on a transverse axis approximately parallel to that of the gun at an angle to the axis of the bore of the gun equal to a certain predetermined angle of elevation necessary to cause the projectile fired from said gun to travel to a given target, and second, noting the moment when the line of sight of said adjusted telescope is caused by the movement of said supporting platform to intersect said target."

This will be recognized as the gun-director system, adopted by all great navies and usually attributed to Admiral Sir Percy Scott, who developed it practically. From it developed Fiske's later patent for applying an individual telescope sight to each individual gun. This was accomplished essentially by securing the telescope, not to the gun itself, where sights had always been secured before—in such position the telescope would have stuck itself through the eye of the gunner in recoiling; but rather to a part of the carriage which moved with the gun but did not recoil.

It would be impossible today even to think of a modern fighting ship without electricity, without telephones. Yet Admiral Fiske has not only seen the old rough-and-ready fighting ship transformed from a rough hull carrying crude guns with small range to a highly specialized fighting machine which is one large and complicated piece of scientific apparatus; he has himself been at the head and front of the army which introduced the modern servant electricity into the fighting machine. It was in connection with his range finders that the first telephone was ever put on any fighting ship (the U. S. S. "Baltimore").

The invention of the torpedo plane has not yet been recognized by the world at large to the extent which Admiral Fiske believes it will be recognized; but it has been virtually adopted by the British, Italian, Japanese and American navies, and its development is being strenuously prosecuted. The torpedo-plane system of fighting is that by which an airplane or sea-plane, equipped with an automobile submarine torpedo which may be detached at the right moment, attacks a fighting ship and launches the torpedo at such close range and with such easy aim that the ship is practically helpless before the attack.

Admiral Fiske believes that the day of the big-gun, armored ship, as the paramount fighting unit on the sea is nearly over. And he bases his belief on a simple argument, which critics have not yet been able to refute.

"In considering the relative merits of two fighters, whether they be men with fists, or men with pistols,

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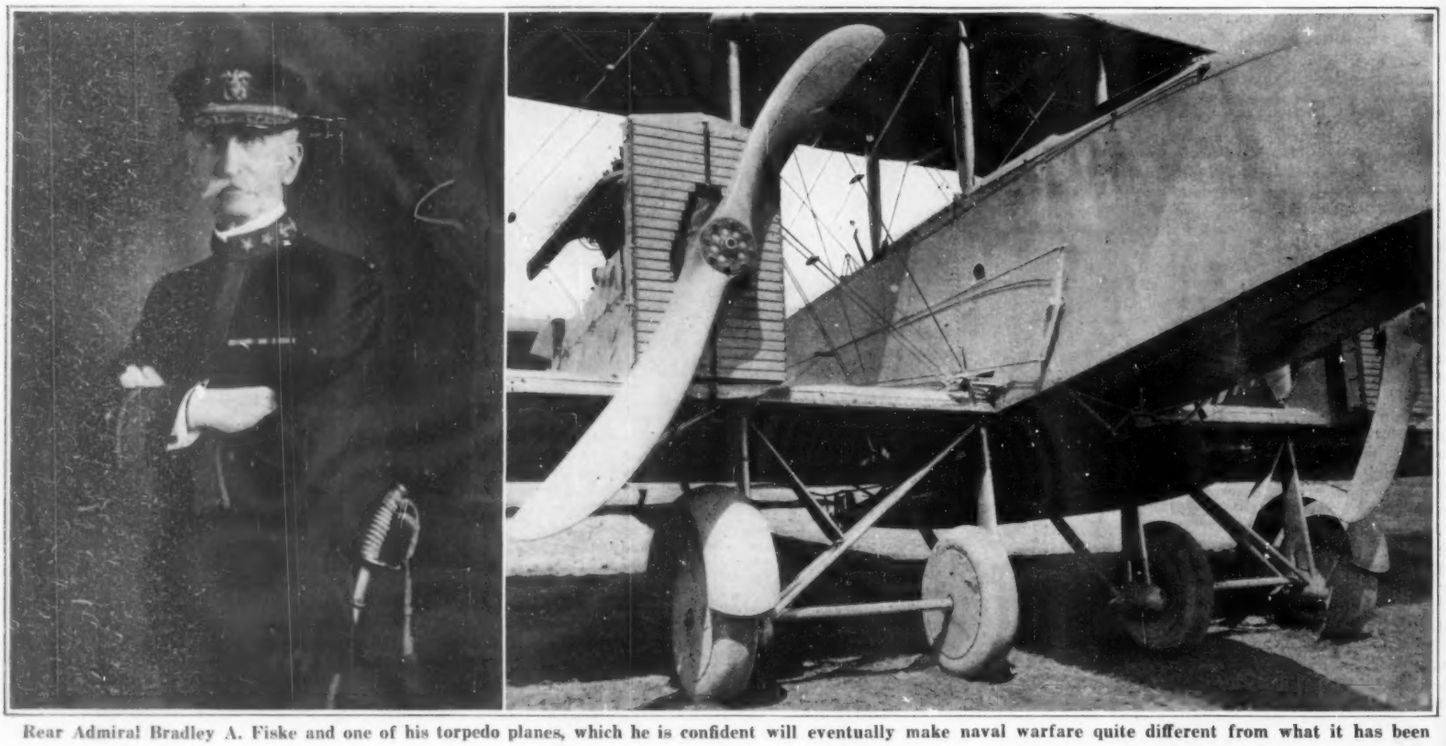


**Rear Admiral Bradley A. Fiske and one of his torpedo planes, which he is confident will eventually make naval warfare quite different from what it has been**

## Current Issue of the Scientific American Monthly

THE paper read before the recent meeting of the American Association for the Advancement of Science, by Prof. Albert A. Michelson, announcing that by means of the interferometer, he had been able to measure the diameter of the star Betelgeuse in the constellation of Orion, has awakened public interest, anew, into the vast extent of the universe. Of peculiar interest in this connection is the leading article of the January issue of the SCIENTIFIC AMERICAN MONTHLY entitled "Limits of the Universe," by Dr. Svante Arrhenius, president of Nobel Institute of Physical Chemistry at Stockholm. He outlines the recent researches which have extended our concept of the star-filled heavens. The calculated distances of certain stars lie between 500,000 and 1,600,000 light-years and the distance of certain nebulæ are estimated at the stupendous figure of twenty million light-years. As Dr. Arrhenius says, in conclusion, "We shall never be able to prove that the universe is infinite in space as well as in mass, but the millions of light-years with which our vision has been so suddenly enriched would indicate that no bounds are set to the spirit of research except those which are involved in the imperfection of our tools."

Charles W. Gilmore, Associated Curator of the United States National Museum, describes a new horned dinosaur from Canada, known to science as the *Styracosaurus albertensis*. This ancient animal had a skull 6 feet long which fairly bristled with horns. Dr. Gilmore compares the skull of the *Styracosaurus* with that of a horned toad, showing a very striking similarity, except that the latter is only an inch long. Were the horned toad enlarged seventy-two times to the size of its ancient cousin, its appearance would be even more bizarre than that of the dinosaur.

One of the most interesting of aquarian specimens is the little seahorse whose habits differ materially from those of other fish. The seahorse may be called the "kangaroo" of the sea, for it carries its young about in a kangaroo-like pouch. Strangely enough it is the male that carries the baby seahorses and shelters them until they are old enough to take care of themselves. When the father seahorse has arrived at the conclusion that the young must fare for themselves, he sends them out into the world by scraping his pouch against a rock or shell.

An interesting article entitled "The Cult of the Sound Body" describes the apparatus employed in modern physical laboratories to test physical development. The illustrations show the special apparatus devised by Dr. Boigey and Professor Demeny which have been installed at the Ecole Joinville. There are also several interesting pictures of apparatus for testing athletes employed in German schools of physical culture.

Is oxygen necessary for animal existence? The question is asked and answered by Dr. O. Krummacher. We used to believe that oxygen was indispensable to life until we found that certain minute organisms would flourish when entirely deprived of oxygen. Then we discovered that there are many bacteria to whom oxygen is actually fatal. It has been demonstrated that vital activity without oxygen is possible not only in one-celled organisms but also in animals with well developed systems of muscles and nerves. Just as it is possible to build an engine which would burn hydrogen and chlorine instead of oxygen and carbon, so it is possible for a living organism to produce chemical energy by the combustion of other gases, but the higher animals have learned to depend upon oxygen because it is found everywhere on our earth.

The efficient distribution of material in designing to withstand stresses in the structure is of prime economical importance especially in some of the modern mechanical developments such as airplanes where weight is a restricting factor. The quantitative determination of stress distribution and direction at all the various points in machine members is at best an intricate matter. A new method of determining stresses has been developed by George Weed Hall and Arthur L. Kimball, Jr., who are authors of an article on this subject. They determine stresses by transmitting polarized light through transparent models of the members to be investigated. The color effects produced in the model permit of measuring stresses which could not be calculated by mathematical methods.

A mine of useful information is contained in the article entitled "Metal Substitutes," which describes the various metals and alloys used in Germany to replace those made scarce by the war. The article is an astonishing revelation of the inexhaustible patience and marvelous skill of the German metallurgists. The translator of this article, C. Powell Karr, who is a member of the engineering staff of U. S. Bureau of Standards, has added appreciably to its value by his bracketed notes and criticisms.

Under the title "Weather Conditions and Flight," C. LeRoy Meisinger describes the climatological factors governing the selection of air routes and flying fields. Meteorology is the mainstay of aviation regardless of the confidence of the aviator in his motor and its ability to carry him safely over all obstacles. The record of our aerial service shows that the weather is responsible for the greatest number of accidents and forced landings. Many of these could be avoided by giving the weather its due consideration. Here is one of the places where the consulting meteorologist is certainly needed.

These are but a few of the leading articles in the January issue of the SCIENTIFIC AMERICAN MONTHLY in addition to which there are the usual departments of progress in general science, chemistry, electricity, mining and metallurgy and mechanical engineering.

A new department starts with the January issue devoted to the research work of the United States Bureau of Forestry. This is prepared by the Forest Products Laboratory at Madison, Wisconsin. The new department is to appear every second month.

## Wind Storms Made to Order

THAT day is past when a thunder storm or tidal wave or cyclone in the films has to be announced by a title. Present-day audiences want realism, and that means the showing of the thunder storm or tidal wave or cyclone in picture form. A mere flip of the author's pen sets the scenery for his readers, and it is just as easy for him to call for the destruction of the Woolworth Building or the wrecking of the "Leviathan." But when it comes to filming—well, words cannot tell the story; nothing less than realistic action, no matter what may be the cost, is necessary.

Now wind storms are often required in photoplays. They do not always occur when wanted, and it costs time and money to wait for them. So—and this is typical of the ingenuity of the motion picture folk—a mechanical genius at one of the Fort Lee, N. J., studios got busy and developed a sure method of producing a wind storm wherever and whenever wanted. Taking a light automobile chassis and an eight-cylinder airplane motor fitted with a propeller, he developed the compact wind machine which is featured in our present cover illustration. When in operation this portable wind machine has to be chained to the ground lest it start off on its own account. The propeller blows the air past the engine and toward the scenery, as shown. The speed of the engine may be controlled so as to obtain anything from a gentle breeze to a full-fledged hurricane capable of bowling over the kind of scenery employed in motion picture work.

## How Do Butterfly Wings Photograph Themselves?

SOME very curious biological experiments with respect to the self-recording power inherent in the delicate wing of a butterfly or a moth have been recently made by a German scientist named Gustaf Wolff, and are reported at length in the January issue of SCIENTIFIC AMERICAN MONTHLY.

When a butterfly's wing is laid for a considerable length of time upon a photographic plate, in a dark room, a clear image of the wing makes its appearance upon the plate when the latter is developed. In general the images are of the positive character, the dark parts of the wing coming out most strongly, while white portions make no impression at all upon the plate. Mr. Wolff states that it is the scales of the wing which exert the photographic influence, since when these are removed the wing fails to record itself upon the plate. The removed scales, however, are found to register on a plate.

## Effect of Arsenic in Steel

IN view of the fact that the question has frequently arisen as to the effect of varying percentage of arsenic in steel, it was deemed expedient to make a few experiments at the Naval Gun Factory, Washington, in connection with the regular manufacturing operation on the effect of this element.

Two series of experiments were made, the first consisting of a comparison between a plain converter steel and steel from the same heat to which had been added 0.10 per cent arsenic. The second series was identical except that an addition of 0.50 per cent arsenic was made.

After making the final addition to a regular converter heat a 3¾-inch diameter by 32-inch long split ingot mold was top-poured from a bull ladle for this plain test. Then about 2 inches of steel was poured into a hot bull ladle of about 100-pound capacity, to cover bottom, the metallic arsenic, mixed with several times its weight of thermit and wrapped in paper, was thrown in ladle, the ladle was then filled with steel, mixed and top-poured into a similar mold. This constituted the arsenic test ingot. Both series were handled in the same way.

The ingots were stripped the following morning, sent to forge shop, heated and forged longitudinally from bottom end to ¾-inch square, and cut into 6-inch lengths—a convenient size for test bars. They were not soaked or annealed before forging, but both series worked excellently while being forged. All of the 6-inch lengths were annealed at 1,400 degrees Fahrenheit and then heat-treated.

The results of these tests show practically no difference between the steel containing no arsenic and that to which arsenic has been added. While it is evident from these experiments that 0.3 per cent of arsenic is not injurious, as far as static testing can disclose, the fact must not be lost sight of that it is extremely hard to get rid of arsenic after it is once present in steel, and if the steel is used for scrap purposes after its usefulness has ceased, there is a constant automatic augmentation of the arsenic content which will in time get beyond the limits desired. It would also be interesting to note the effect of arsenic upon shock-resisting qualities of the steel which is of major importance where ordnance work is concerned.

## A Newly Patented Cheap Building Material

A NEW patent has recently been taken out in Austria (No. 81157) by Dr. Rudolph Ditmar of Graz for an inexpensive building material, designed to relieve the shortage of dwellings which is felt there as well as here. The process is not strictly new, being based upon a system long employed by the Chinese and Japanese and other Asiatic peoples.

The inventor begins by placing two sheets of wire netting parallel to each other at a suitable distance and binding them together with wire. The receptacle thus formed is then filled with gravel sufficiently coarse not to pass through the mesh of the wire. The outer side of the netting is then covered with thick concrete which penetrates the meshes of the wire and unites with the gravel immediately in contact therewith, to form a layer in which the wire netting becomes embedded. After these outer slabs of concrete have hardened the gravel in the middle can be poured out and the space which it occupied filled by asphalt, tar, paraffin, or any other desired filler. Such a substitution is especially useful for the construction of the walls of ships or buoys or other articles where lightness as well as strength is demanded. The inventor claims several advantages for this kind of building material, including cheapness, the saving of more valuable material, and the readiness with which the hollow concrete slabs can be shipped to places difficult of access, such as mountain resorts. Furthermore, houses thus built can readily be "wrecked" without the use of explosives. They also provide an easy means of insulating the systems of pipes which supply the building and furnish excellent protection against extremes of cold and heat. He claims, too, that there is no sweating of the concrete.

## Telegraph Wires as Weather Prophets

TO ears that are trained to distinguish the differences in pitch occasioned by variations in heat, humidity, wind pressure, etc., the telegraph wires which form a network over all civilized countries are said to constitute excellent weather prophets. A certain station master was recently quoted in the German magazine *Ueber Land und Meer* as making the following statements drawn from his long experience:

Predictions as to the state of the weather can be made 24 to 36 hours in advance by a proper appreciation of the pitch, strength, and quality of the tones produced by the wires. In particular rain, snow, and storms can be foretold with considerable certainty. In winter the tones are considerably higher than in the summer since the tension is increased by the cold. High shrill notes precede heavy but brief falls of rain or snow, while deep humming tones indicate rainfalls which are both brief and light. Buzzing tones indicate a change in the weather; indefinite soft, humming tones of medium strength indicate a longer continuance of damp weather.

It is naturally difficult to describe the tones with precision in mere words. They must be heard repeatedly in order that the mind may form consciously or subconsciously an idea of the weather condition to which they correspond. At any rate the station master's prediction of a heavy storm upon the day following the interview proved entirely true.

# Insect Ravages in Our Forests

## The Serious Character of This Plague and the Measures Taken for Protection

By S. R. Winters

THE beetle and other species of insects, stealthy workers that they are, may not commonly be reckoned with as contributing factors to the preponderance of evidence that the Nation's timber resources are being rapidly depleted. The very insidiousness of the pests may be responsible for a tendency of the popular imagination to minimize the depredations of these tireless foes of the woods. To be sure, they are not as spectacular as a forest conflagration or as ravaging as a cyclone, but the destructiveness of insects may outweigh the toll taken by other inimical agencies.

In fact, we have the 1920 official computation of the Forest Insect Investigations, United States Bureau of Entomology, which gives the figures $70,000,000 as the valuation of standing trees annually killed by insects. An additional $30,000,000 is an estimate representing the losses sustained by forest products, such as stored hardwoods being converted into flour-like powder by powder-post beetles. In other words, insect injury is not restricted to "tall timbers" but their depredations involve attacks from the moment the seedling takes growth until the lumber reaches the ultimate consumer. Compare the official estimate—$70,000,000 worth of growing trees yearly—with another Government calculation that forest fires take a toll of only $25,000,000, and you can realize the necessity for any drafted national forest policy taking cognizance of the natural enemies of trees. It is estimated that half of the fir or balsam in eastern United States is either dead or dying because of neglect.

The bark beetles, or technically described as of the genus "Dendroctonus," are the chief offenders of a multitudinous array of insects that are tirelessly undermining tree growth. As far back as 1836—85 years ago—an entomologist denominated the bark beetles as *killers of trees*, and the reputation of the pest is none the less ignominious in the year of our Lord 1920. The results of extensive investigations are unanimous in their verdict that the species of this genus of the beetle constitutes the arch enemy of the forest trees of North America. Depredations by the eastern spruce beetle in the northeastern United States, widespread desolation of pine and spruce by the southern pine beetle in West Virginia and Virginia, the once almost complete annihilation of timber in a National Forest by the Black Hills beetle, and the undermining influence of the western pine beetle in Idaho, Oregon and California are examples subscribing to the fitness of the designation of the pests as "killers of trees."

Virile, upstanding trees are attacked by swarms of the adult beetles, their entrance into the bark being observed on the main trunk of the tree, where they dig their egg galleries for a distance of a foot or more through the inner, living bark. The vitality of the growth is weakened and subsequently the larvae which hatch from the eggs tunnel through and destroy the bark which may divorce one egg gallery from another. The growth is thus completely girdled and death to the tree is inevitable. The toll exacted of our lumber resources in this fashion is staggering, the beetles in West Virginia, New England and the Black Hills National Forest alone mounting into the billions of feet of choicest pine and spruce. Depredations, perhaps less conspicuous, each year invade the forested sections of the Rocky Mountains, Cascade, Sierra, Coast regions and the Southern States. Dr. A. D. Hopkins, in charge of Forest Insect Investigations, Bureau of Entomology, states that if the timber destroyed by insects during the past half a century were living today its stumpage value would be in excess of $1,500,000,000.

1. Dead forest killed by mountain pine beetle. 2. Beetle-infested trees cut down to control depredations. 3. Tools used for pruning. 4. Syringing for borers

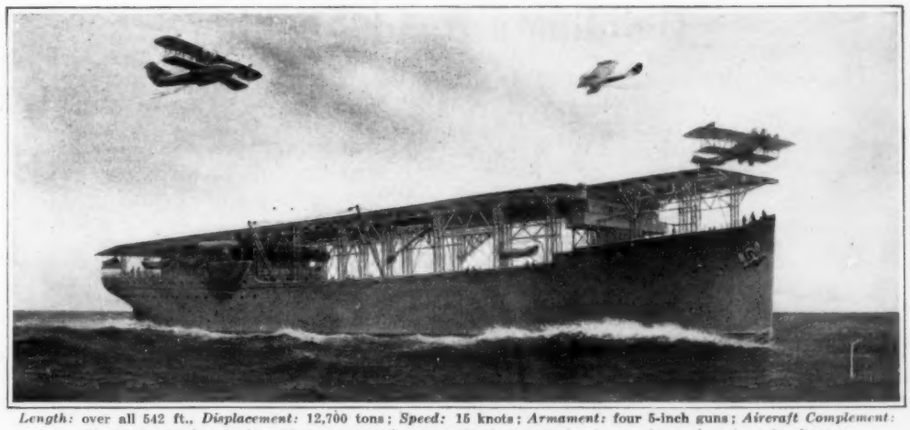
**Destruction wrought by insect pests in our forests, and means of combating them**

Recent years are replete with alarming outbreaks of insect depredations. The conspicuous example of the ravages of the pest in the Black Hills forest reserve is of historical significance, the toll being 1,000,000,000 feet of timber. The trap-tree method was employed in combating the attacks whereby trees were felled as a decoy in attracting the insects, after which the broods were annihilated by stripping off the bark or putting a torch to the entire tree. An outbreak of the eastern spruce beetle in northeastern Maine was subdued by diverting the logging operations from land to floating the lumber on the lakes and streams to distant mills. One logging enterprise, without additional expense,

(*Continued on page 60*)

## The United States Aircraft Carrier "Langley"

THE "Jupiter," which is familiar to the public as one of our naval colliers, is now at the Navy Yard, Norfolk, undergoing alterations to refit her as a Government carrier. She has been renamed the "Langley" in honor of Professor Samuel Pierpont Langley, whose extended pioneer experiments on the problem of mechanical flight made his name widely known.



*Length:* over all 542 ft., *Displacement:* 12,700 tons; *Speed:* 15 knots; *Armament:* four 5-inch guns; *Aircraft Complement:* 12 single-seated pursuits; 12 two-seater fire control; four torpedo planes; six seaplane torpedo planes

**The "Langley" (formerly collier "Jupiter"); first aircraft carrier for the United States Navy**

All of the coal-handling gear has been removed and in its place there is being built a flying deck, located about 56 feet above the waterline and extending from bow to stern, a length of about 525 feet. This deck has a width, amid ships, of about 65 feet, and it will be flush all over, so as to make an ideal platform for flying off and landing. Means will be provided on this deck for rigging an arresting device to facilitate landing. Catapults for projecting the planes to give them the necessary speed for flight will also be provided forward and aft. An elevator will be installed for hoisting the planes from below to the flying deck and around this elevator a palisade will be provided to form a wind break for protection to the planes while being assembled.

Two cranes with large outreach, one on each side of the vessel, will be provided to hoist aircraft out of the water and land them on the hangar deck, which is the deck next below the flying deck. Beneath the flying deck, traveling cranes will be provided for hoisting planes from the hold and for transferring them fore and aft to the shop spaces and elevator. Shop facilities for repairing the planes will include a machine shop, a wing repairing shop, molding spaces, a metal shop and various store rooms.

The hold spaces are being refitted for the stowage of aircraft and their accessories, including aircraft ammunition in the way of bombs and torpedoes, ship's ammunition, fuel oil and gasoline. An elaborate system will be provided for distributing gasoline and lubricating oils to various stations on the hangar deck and flying deck. The characteristics of the "Langley," refitted as an aircraft carrier, are as follows:

| | |
|---|---|
| Length between perpendiculars | 520 feet |
| Length overall | 542 feet |
| Beam | 65 feet |
| Speed about | 15 knots |
| Displacement about | 12,700 tons |
| Gasoline capacity | 578 tons |
| Guns | 4-5 inch |

The smoke pipe has been rearranged so as not to obstruct the flying deck and to keep the smoke clear of this deck, in order not to interfere with making a landing. This will be accomplished by providing a short smoke pipe on each side, clear of the flying deck, which will be interconnected so that the smoke can always be discharged on the lee side. One of the smoke pipes will be arranged to hinge downward when considered necessary to discharge the smoke near the water; the other is arranged to discharge the smoke downward through a water spray.

A radio outfit will be provided, carried on masts which are capable of being completely housed below the flying deck. The "Langley" will carry an auxiliary radio outfit, so that the planes can be communicated with when the main radio outfit is housed.

The "Jupiter" as thus reconstructed under her new name of "Langley" will carry twelve single-seater pursuit planes capable of maintaining a speed of 100 knots for three hours; twelve two-seater fire control planes capable of cruising for four hours at an elevation of 10,000 feet and having a full speed of 100 knots; four torpedo planes capable of flying at 100 knots for two hours, and six seaplanes built as torpedo planes capable of 80 knots' speed for four hours.

## Surgery and the Weather

THE well-known Boston surgeon, Dr. Huntington, has been making certain observations as to the possible effect of meteorological phenomena in surgical operations. He has come to the conclusion, after studying many cases in the two largest hospitals of the city, that a high degree of humidity, 80 per cent or more, is the optimum condition for the performance of surgical operations, with a fall to about 60 per cent two or three days later, with a temperature of 18° C. (64-5° F.). Dr. Huntington believes that these conditions could be artificially produced in the operating rooms.

## The United States Light Cruiser "Omaha"

AN important section of the three-year program which was drawn up before we entered the war was the provision for ten scout cruisers, a comparatively new type of vessel, at least as regards its steaming radius and high speed. The most notable features of our new designs as compared with those of contemporary navies was their high speed of 35 knots, their large displacement of 7,100 tons, and their battery of eight 6-inch guns.

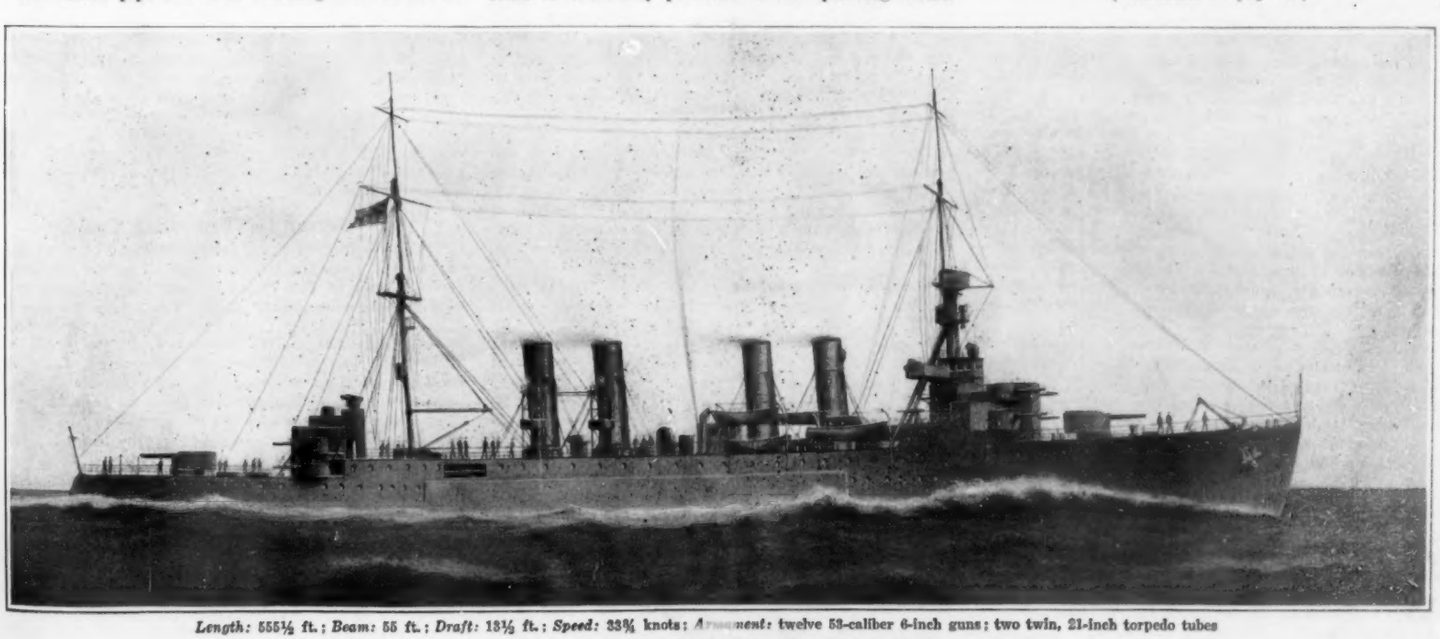
Since the designs were first drawn up, modifications have been made in the direction of increasing the strength of the hull and the power of the battery, and this has resulted in an increase of the displacement from 7,100 to 7,500 tons and a decrease in the speed to about 33.75 knots.

As will be seen from the dimensions, these vessels, so far as the hull is concerned, are practically exaggerated destroyers; for with a beam of 55 feet and a mean draft of 13 feet 6 inches, they are 556 feet 6 inches in length overall, giving a ratio of beam to length of one to ten. When the designs were first brought out, some fear was expressed as to whether their shallow depth, as affecting their girder strength, would not cause them to strain heavily when steaming head to sea; but from the official drawing from which our own wash drawing has been prepared, we gather that the freeboard for over one-third of the length amidships has been raised one deck. If so, this will give greater strength and add both to their seagoing qualities and to their appearance. There is a pronounced sheer with considerable lift toward the bow, which, even as it is, will be none too lofty if these boats are to be driven at nearly 34 knots in average weather. The motive power as originally designed consisted of geared turbines operating on four shafts with a combined shaft horsepower of 90,000.

The battery will be numerous and powerful, consisting of twelve of the new-pattern 53-caliber 6-inch guns. It will be mounted as follows: on the fo'castle deck will be a two-gun turret, abaft of these on each side of the bridge will be two guns mounted in superposed sponsons, all of these six guns being forward of the bridge. Aft will be a similar arrangement of six guns, namely, a two-gun turret well aft on the quarter deck, and forward of this, on each side, two guns in superposed turrets, these latter being slightly aft of the after bridge.

An interesting novelty, at least in the United States

(*Continued on page 60*)



*Length:* 555½ ft.; *Beam:* 55 ft.; *Draft:* 13½ ft.; *Speed:* 33¾ knots; *Armament:* twelve 53-caliber 6-inch guns; two twin, 21-inch torpedo tubes

**New scout cruiser "Omaha"—class of ten ships**

# Building a Rigid Airship

## The Construction of a Dirigible, from the Frames to the Finished Ship

THE metal parts of an airship are manufactured in engineering shops equipped with special machinery, while the gasbags and outer covering are made in sheds of a suitable character with large open floors and with heating arrangements to maintain the air at a constant temperature. The methods of manufacture of the girders and other parts of the hull framework, the cars, rudder and elevator planes, and all other components of the airship, do not offer any special difficulties, and the processes adopted are those of ordinary engineering practice.

The metal invariably used for rigid airship construction is "duralumin," an alloy of aluminum characterized by combined strength and lightness. Its specific gravity is only 2.8, but it has a breaking resistance of 23 to 30 tons per square inch of section. Thus, although only one-third as heavy as mild steel, bulk for bulk, it is almost equally strong.

The bracing pieces for the girders are stamped out of strip, and pressed to shape in dies which corrugate them length-wise for the purpose of stiffness, except at the ends and in the middle where they cross one another. The main members are drawn out of strips to the required channel-section, and drilled for rivets in a special machine which automatically feeds them forward and drills them; the spacing between two adjacent holes being accurate to one-thousandth of an inch. As an enormous number of holes have to be made in these parts, the machine is a great saver of labor and time.

The bracing-pieces are riveted to the main members by pneumatic riveters. The rate at which the rivets can be closed is practically that at which the rivets can be placed in the holes.

Most of the girders are triangular in section, having three main members held together by as many sets of bracing pieces forming a lattice-work girder. To the uninitiated, the lightness of the girders is astonishing. A girder thirty feet long can be picked up with the greatest ease, for it weighs only some 15 pounds. Not less surprising is their strength—relatively to weight. A girder of the length and weight mentioned is able, if supported at the ends only, to carry a distributed load of 30 pounds per foot—900 pounds in all; or, alternatively, 450 pounds (the weight of three average men) concentrated at the center of the span. Such girders have the highest strength-to-weight ratio of any similar constructions yet produced.

In the engineering shops are assembled also the framework of the machinery and control cars. These are built up of members of a more substantial character, as the loads to be carried are greater and more concentrated. In principle, the arrangement of the parts is the same as in the hull; longitudinals held together at intervals by circumferential ring frames, the whole tapering aft in streamline form. Under the floor level the cars are covered in with duralumin sheeting; above, with fireproof fabric.

In the gasbag shed, girls stick the goldbeater's skins by means of rubber solution, on to sheets of cotton fabric, which are subsequently made up into the gasbags. The skins, of which over a quarter of a million are used in one rigid airship, are applied so as to overlap one another, trimmed off at the edges, and flattened down with the scissors. The process necessarily is a long one, since each skin covers but part of a square foot of fabric. Before lining, the fabric is made up into gores and ends of predetermined form and dimensions, so that when stuck to each other they make bags circular in section and having the necessary taper in one or both directions to fill accurately the compartments in the airship to which they respectively belong.

Each bag when finished is inflated with air and inspected from the inside, any faulty places being made good. The various fittings for the attachment of the gas valves, the filling necks, etc., are then fixed in position, and the gasbags are ready for the airship.

A bag after being passed as satisfactory, is folded up and packed for transfer to the airship-building shed.

The outer cover, of linen, is made up into pieces having a width equal to the length between two transverse rings of the hull structure, and a length equal to half the circumference of the section of the framework which they fit. The shape is of course such as to give a correct fit on the ship. The edges are provided with eyelets to take the cords by which the cover-sections are laced to each other and to the frame.

We now come to the erection of the complete airship in the shed, and reach problems entirely different from those met in ordinary engineering, and it will be of interest to describe the system generally adopted for the erection of a rigid airship.

Cradles on which the hull framework of the ship is to be built are first of all erected and carefully lined up. The transverse rings forming the main and intermediate transverse frames of the structure are assembled in horizontal position on trestles on the shed floor. The hull is built up in short sections in a vertical position, each section comprising four transverse rings, and the lengths of longitudinal girders joining them up.

The method of building these rings is first to support two rings at the correct distance apart, and then join these up with longitudinal girders. The section thus erected is then lifted up, and another ring put underneath and joined up with longitudinal girders, the section being thus extended until it is of the maximum size which can be conveniently handled. The bracing wires between the joints and framework are put into position, accurately set up to the proper tension, and then finally fixed.

After completing the section, it is lifted up clear of the floor by means of tackle from the roof of the shed, and then turned over into the horizontal position. It is then transferred to the cradles after being fitted with rollers at each of the main joints, which enables the whole section to be rotated on the runner rails which are fitted to the cradles.

As a series of these sections is completed and transferred to the cradles, they are joined up by putting in place the longitudinals between their adjacent transverse rings, and fitting the necessary wires, etc. To enable this to be done, the sections are rotated in their right relation on the cradles, which enables all work in connection with putting in the joining-up girders and riveting, etc., to be carried out entirely from the stagings erected underneath the hull, thus eliminating all need for work to be carried out on the upper part of the airship with consequent risk of accidents and difficulty of access.

**The views on the facing page show features of present-day rigid dirigible construction as follows:**

1. Assembling the transverse frames on the floor of the huge airship hangar. 2. A section of the structure as built vertically. 3. Sections of the hull structure on the cradles for joining up. 4. View looking through the interior of the finished hull structure. 5. Structure of one of the "power eggs," the miniature shapes that are assembled on the side of the main hull toward the bottom, to carry the engines, etc. 6. View of the completed keel structure with the gasoline tanks in place. 7. The gasbags being inflated and the outer cover being placed in position.

When all the sections of the hull framework are finished on the cradles, and joining-up is completed, the net wiring—which is fitted on the inner circumference of the framework to take the gasbag pressure—is fitted, and the hull is now finished and is fixed in its normal position, with fabric coverings on the longitudinal girders to obviate chafing of the gasbags against the girders.

The stabilizing fins and rudder planes, which have already been completed, are fitted in position at the aft end of the ship. The navigating and machinery cars are placed in position under the ship, and suspensions and attachments between them and the ship are fitted in position.

The fuel tanks and water-ballast bags are slung in their proper positions in the keel corridor, and all the control wires and gear for the operation of the rudders, water-ballast valves, etc., connected up to the navigating controls in the control car.

When all this work is completed, the gasbags are slung up in position, and when ready, are connected up to the hydrogen supply pipes, and the bags are all gradually filled simultaneously, this operation of gassing the ship usually taking from three to four hours.

As the gasbags are filled, the sheets of outer covering fabric are put into position and laced up. It is very important that the outer cover should be well stretched over the ship, as this not only helps to counteract the internal gas pressure on the hull girders, but the tautness has a very important effect on the resistance and speed of the ship through the air. In order to attain and preserve a suitable tautness of the cover, it is now the practice to dope the fabric after being fitted and stretched in position, which not only tightens the cover and gives it good surface, but also greatly increases the weather-proofness and obviates variation in the tautness of the fabric due to the humidity of the air.

After the outer cover is completed, the gasbags fully inflated, and all the other work on the ship completed, the ship is then ready to undergo what corresponds to the dock trials of a steamship. She is secured floating clear of the floor and sides of the shed, and her engines are run for several hours, driving the propellers, while tests are carried out to ensure that all gears and controls function properly.

At last comes the event to which all responsible for her design and manufacture have long looked forward, namely, the trial flight. The fuel tanks and ballast bags are filled; the crew and observers go aboard; ballast is carefully tested; the shed doors opened; and the handling party lead her out into the open air. A few minutes later, after a final test of her trim and ballasting, she is speeding away, followed by the good wishes of the hundreds who have been engaged on her construction.

## Hydroelectric Development in Portugal

IT is reported in the daily newspapers that the Portuguese Minister of Commerce has appointed a commission to study the matter of the utilization of the water power of the rivers of Portugal for the purpose of furnishing hydroelectric power for railway, power, and lighting purposes.

Two engineers, Senhores Fernando de Souza and Vicente Ribeiro, have been nominated by the representatives of the Portuguese National Railways to sit with this committee, which has been created at this time to study these matters principally because the outlook for fueling supplies for Portugal, which possesses no working coal mines, is not at all bright, owing principally to the high prices of imported coal, the present low value of the escudo in the American markets, and the uncertainties as to available coal supplies in producing countries.

In the case of the Portuguese rivers it would be necessary to construct an extensive and likewise expensive system of dams, with a view to conserving enough of the water from the winter rainfall to last through the summer.

The headwaters of the largest Portuguese river, the Douro, are situated across the frontier in Spanish territory, and for this reason, before any definite plans for the utilization of its power can be formulated, it will be necessary for the Portuguese and Spanish Governments to come to some sort of an agreement for the division and distribution of the Douro water, for as matters stand now it is possible for Spaniards having farms in the basin of the upper Douro to divert practically all of its waters for irrigation purposes.

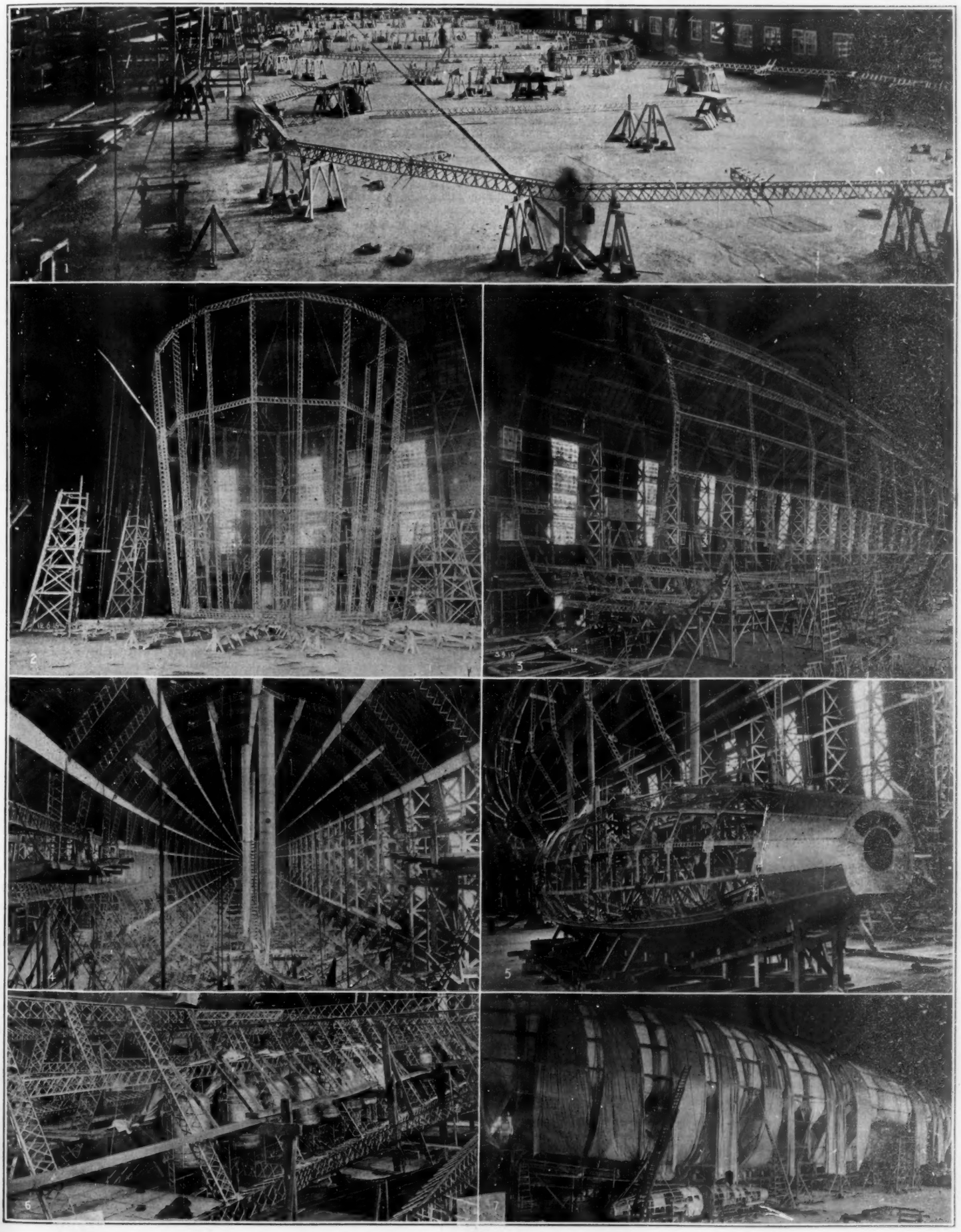
This commission will also be expected to study the question of the utilization of a number of seams of coal which are known to exist in Portugal, and it is even possible that it will study Portugal's petroleum possibilities as well.

## New Record for Unloading Collier

TWELVE thousand and thirty tons of coal were discharged from the collier "Ulysses" at the Cristobal coaling plant of the Panama Canal in 15 hours and 25 minutes on November 12-13. The collier docked at 8:50 A. M., November 12; unloading was begun at 8:55 A. M.; at 12:20 A. M., November 13, the cargo of 12,030 tons had been completely discharged, the ship cleaned up and all men were off. Cleaning up and taking the men off usually requires about an hour.

The discharge was effected by means of the 4 unloaders of the plant, equipped with four 2½-ton clamshell buckets. Four unloaders worked from the beginning until 3 P. M., 3 continued from that hour until 11 P. M., when 2 were discontinued, and the unloading was completed with the use of 1 unloader.

About 6 hours of the work was performed after dark. The new record beats the previous record for discharging the collier at this plant by 6 hours and 10 minutes. The work was rushed in order to allow the ship to return with minimum delay to Newport News for another cargo, as in the present shortage of coal every effort is being made to increase the stock of bunkers.



# The Story of the Prune

## How California Growers Handle Their Crops from the Tree to the Consumer

By G. Orb

IN 1856 a Frenchman, Louis Pellier, brought two prune trees to this country and planted them near San Jose, in Santa Clara County, California. These grew; other plantings were made; slowly an industry had its beginning. In the early seventies prunes began to be shipped commercially to the States west of the Mississippi; in 1896 a tariff of two cents per pound was placed on foreign prunes imported into this country, thus protecting the little new industry of California. And today California produces 90 per cent of all the dried prunes and apricots consumed in the United States and Canada, with an output of something like 200,000,000 pounds per annum.

More than half the prunes grown in the whole United States are produced in the Valley of the Santa Clara. Here is located what is perhaps the largest deciduous fruit house in the world, packing in different years, according to size and quality of the fruit, from 500 to 900 carloads, all sorted and boxed by experienced hands and shipped to almost every corner of the globe —China, Europe, South America, South Africa, and so on.

In the last days of March or early April the Santa Clara Valley looks like a vast snowfield glistening in the sun—a hundred and twenty-five square miles of vineyards and trees in snow white blossom. By late August or early September these blossoms have turned into the ripened fruit; earth and sun and air have completed their wonderful work. Not even now does man disturb the completion of this work, for the prune is permitted to ripen and fall from the tree. It is never picked, as these last few days on the tree so largely increase the sugar content and hence the value. These prunes may lie on the ground a week or even a bit longer before the women and children come in with basket and pail and begin to pick them up and fill the empty boxes in which the teams haul them through the orchards. Usually, the ground is picked over three times before the end of the season. At the last picking the trees are shaken to bring down all the fruit.

From the orchard the prunes are hauled to the dipper and drying ground. First they go to the dipper, an iron tank containing about five pounds of lye to 100 gallons of water, which is kept boiling hot. The prunes are dipped into this tank for about thirty seconds by means of a wire basket or revolving drum. Following removal they are passed under a wire screen with strong jets of clean cold water flowing on them, and washing off all sediment and lye-water. They are then spread on trays measuring three by eight feet, ready for the drying ground. The hot lye bath, by the way, has slightly broken the skin of the prune, so that the moisture may the more easily escape in the drying process.

Again the rays of the sun are called upon, for prunes are dried solely by the sun, taking from five to ten days for the completion of this phase. The drying grounds may be twenty or thirty acres in extent. At times there are spread out upon these fields twenty to thirty thousand trays, containing some 2,000,000 pounds of prunes, which when ready for the market would be valued at almost a quarter of a million dollars.

Bins in the grower's fruit-house serve to store the sun-cured fruit until it can be sacked and delivered to the packing house. Some seasons, when deliveries can be made prior to September 30th, a premium of one cent a pound is paid and deliveries are made direct from drying ground to packing house. During the last days of September and until the time limit has expired, day and night, a continuous line of trucks and farm wagons unload the new dried prunes at the packing house door. Here they are weighed and tested and then emptied from the sacks on to the carrier which takes them to the grader. The floor of this carrier is perforated with holes, and it is kept continuously vibrating for the purpose of sifting out dirt and sticks. From the carrier the prunes are emptied on to the grader proper.

In the twin grader there are two parallel streams of prunes flowing over metal screens that are perforated with holes of increasing size as the prunes progress. As the prunes pass along the perforated screen the small sizes drop through first and the larger ones pass on until they too find an opening of sufficient size to fall through to the bin below. By the time the stream has reached the end of the grader, all prunes have dropped through and have been graded according to size. From these bins wheel-barrows deliver the prunes to the processor. The grading determines the size and hence the price paid to the grower.

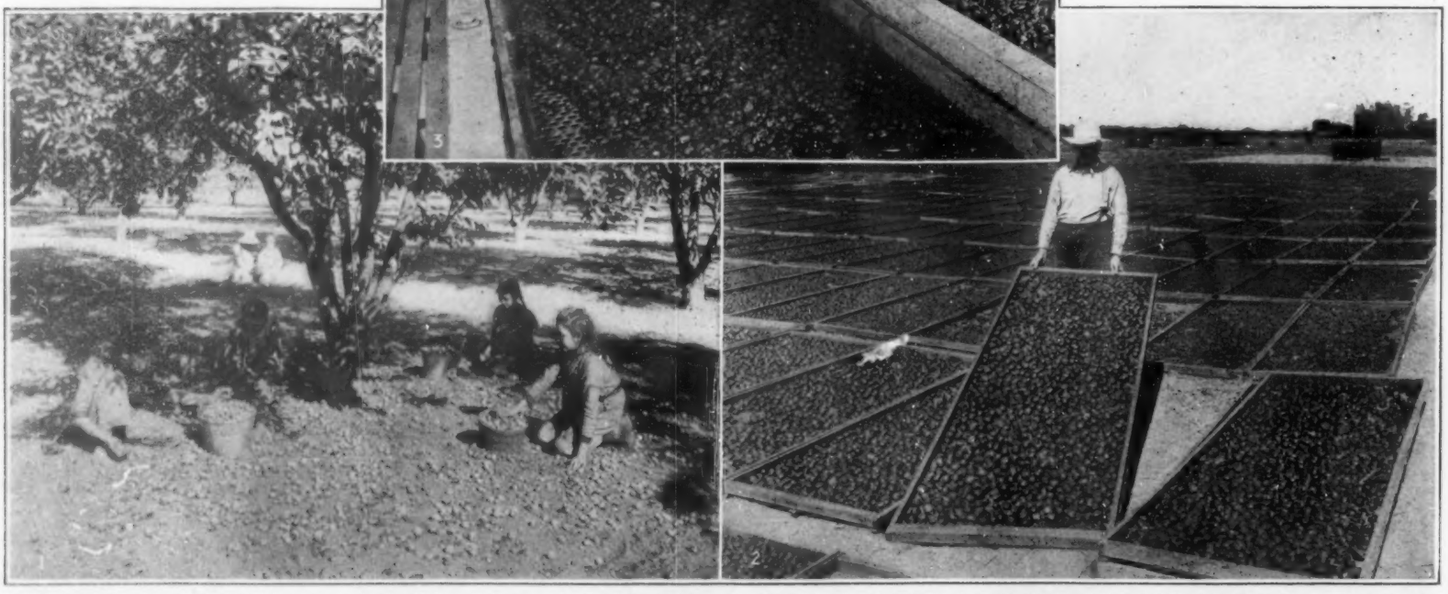
The "processor" prepares the graded fruit for packing. It is boiled or steamed for about three minutes, then run over a screen to drain, and while still warm is emptied into the box or carton, weighed, and the lid clamped on by a high pressure nailing machine. The boxes of fruit are carried to the freight car waiting on the siding.

Apricots are similarly packed except that the pit is removed and that they are not put through the "processor."

The Italian prune is grown in Oregon to the extent of some 25,000,000 pounds per annum. This prune has a tart flavor and is sold to a restricted class of buyers, the Jewish population of our large American cities buying a large portion of this crop.

Three and a half years ago—May 1, 1917—a prune and apricot growers' association came into being, purposing to operate a non-profit selling agency which should be strictly coöperative, returning every cent of profit over and above actual cost of operation to the growers whose orchards produced the fruit.

When we know that California produces some 200,000,000 pounds of dried prunes annually, or 90 per cent of all the prunes and apricots consumed in the United States and Canada, and that, prior to May 1, 1917, the marketing of this entire crop was dominated by a very small but powerful group of independent packers who year after year had forced the growers to sell for barely enough to buy themselves living necessities, we realize why the organization came into being. This association has proven a wonderful experiment in coöperative marketing, scoring a success that has been little short of phenomenal. Today the association has a membership of 10,000 growers, operates 37 large packing houses, and has established more than 250 selling agencies in the United States alone, with more than a score located in foreign cities where markets are being developed for the large crop a few years from now.



1. Prunes are never picked. They ripen on the tree and drop to the ground. Then the whole countryside works from daylight until dark gathering the fruit before it can spoil. 2. Sweating out in a California sun bath. Prunes are not dried artificially. They are cooked for six days under the rays of the hot September sun. Some of the drying fields hold 25,000 trays at a time, on which are spread a quarter of a million pounds of fruit. 3. Down goes the prune when it comes to the right-sized hole. The customer pays for prunes according to size, hence this grading process.

**Some phases of southern California's prune industry, from the tree to the grading process**

An unusual chair and table fashioned out of knotty maple wood by a western craftsman

## Maple Knot Furniture

OUT in the wildest mountain fastness of Washington lives a man who spends a great part of his time in the forest in searching for particularly knotty trees. He always makes a fortunate find, for the commercial lumber hunter passes by the very kind of tree for which this man is hunting.

After the tree is felled it is ripped into workable lengths with a cross-cut saw. The pieces are then cut into shape with a small hand axe. Where necessary the essential pieces are fastened together with the most primitive of equipment. The great majority of the pieces of furniture are in a solid state cut and shaped out of a great knot of maple wood. The wood, in practically every piece, is so hard that it is impossible to form holes for fastening arms or legs. In the rustic oddity of this forest-carved furniture there is a great deal of exceptional artistic taste and the sturdy ruggedness of the chairs and tables this man has made give them splendid adaptability to a mountain house.

The illustration above shows a rocking chair and a table made out of knotty maple wood. Note how the craftsman has worked in odd pieces of wood in order to give graceful lines as well as the desired grain effect. The rockers of the chair and the legs of the table are, of course, carefully shaped so as to give the necessary strength to the furniture.

## Freaks of the Vegetable World

THE two specimens presented in the accompanying illustrations are very unusual freaks of the vegetable world. It is not such a rare occurrence to come across a potato or carrot or other vegetable which bears a striking resemblance to the human head or body; but the present specimens are exceptionally interesting.

The first or upper illustration shows a strange monster which suggests a reptile of antediluvian days. Yet it is nothing more than an ordinary yam, or sweet potato. This freak tuber was raised on a farm near Cairo, Ill., and measures 18 inches long.

Obviously, the eyes and mouth have been added to emphasize the monster-like appearance of the potato, but the carrot has not been altered.

The second or lower illustration shows a freak carrot which grew in a startling way. It bears a most striking resemblance to the human hand, which is shown beside it by way of comparison.

Two freaks of the vegetable world: A sweet potato resembling a gila monster, and a carrot shaped like a hand

## Where Is That Forest Fire?

WITH thousands upon thousands of acres of dense forest land to contend with, the location of a forest fire by the forest rangers would at first thought appear to be a complicated matter. Yet such is not the case. The forest officer depicted in the accompanying illustration is locating a forest fire by means of alidade and segmented circle. Two or more stations equipped with such finders report to a central office the angle upon which they locate the smoke. Intersecting lines on a master map, orientized with those in use by the lookout men, give the exact location of the blaze.

## Observing Currents from High in Air

THE individuals shown in the accompanying view are not performing acrobatic stunts nor suspended from earth by reason of their eccentric modes of living. They are observers at a cable gaging station constructed in Bolivar County, Miss. Moreover, these experiments were designed to test the well-known formula of Kutter as the accepted standard for determining the flow of water in open channels.

The experiments were conducted under the guidance of the Drainage Division of the U. S. Bureau of Public Roads, and when supplemented by a study negotiated by the engineers of the Miami Conservancy District of Ohio, the conclusion is: "Although the Kutter formula is not ideal it is the best equation available at the present time." The field velocity measurements in Mississippi were made with a small Price current meter. The measurements were obtained at intervals of 2½ feet across the streams for the smallest channels, 5 feet for the medium-sized cuts, and 10 feet for

A cable gaging station on the Mississippi River for measuring the rate of flow

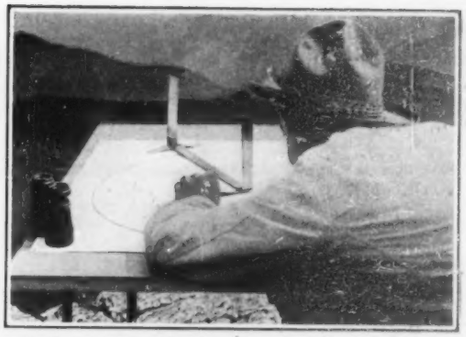
the largest ditches. The velocity, at the measuring points, was obtained at the surface, mid-depth, and bottom of the stream.

Experiments similar to the one in Mississippi were conducted in Tennessee, North Carolina, Iowa, and Florida. Among the conclusions announced as of value to engineers in the study of the flow of water in dredged drainage ditches are: A deposit of slimy silt on the sides and bottoms of a channel substantially lessens frictional resistance to flow; clearance of ever-growing vegetation or shrubbery from a channel will perceptibly enhance its capacity; an accumulation of débris, trees, logs, and other obstructions in a ditch will greatly decrease its capacity; a dredged channel rapidly deteriorates in hydraulic efficiency unless systematically maintained; abrupt variations in a cross section play no inconspicuous part in minimizing the hydraulic efficiency of a ditch; after a certain amount of erosion has taken place in the ditch continued wearing action does not necessarily increase the roughness of the perimeter.

Engineers and other parties interested in a detailed discussion of the results of experiments relating to the subject of the flow of water in dredged drainage ditches should apply to the United States Bureau of Public Roads, Washington, D. C., requesting a copy of a professional paper written by C. E. Ramser, senior drainage engineer.

## Spotting Whale Meat in Sausage

AS a subterfuge whale meat cannot be mixed with beef and pork in the composition of sausage without its presence being revealed by chemical analysis, according to a formula worked out by the meat inspection laboratories of the Bureau of Animal Industry. The fat of the whale and other marine products varies from that of cattle, hogs, sheep, and other land animals in essential particulars, chief of which is the presence of the glycerides of highly unsaturated fatty acids.



A forest officer locating a forest fire with alidade and segmented circle

This ingredient has the capacity of joining with bromine in forming highly insoluble compounds. Glycerides are evident to a substantial degree in whale fat but are not found in meat animals or vegetable oils.

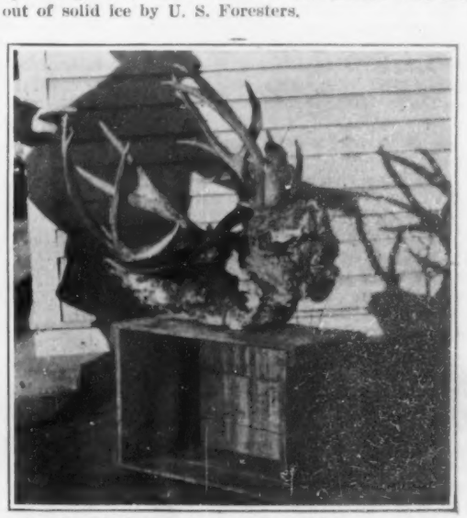
The method developed by the meat inspection of the Federal Government for the detection of whale meat in sausage had its origin in an experiment with a mixture of canned whale meat and Frankfurter sausage. The marine product had been cooked before canning and there was an absence of visible fat, while the Frankfurter sausage used was an ordinary sample. The test specimen contained 20 per cent whale meat, which was shredded finely and incorporated intimately with the sausage. Sixty grams of the mixture were then extracted with ether, the product having contact with ether for two or three hours. The ether was then filtered off, and evaporated on the steam bath, the fat obtained being examined by the following method used by the Bureau of Chemistry in detecting the presence of whale and fish oils in vegetable oils:

"Dissolve in a test tube about 6 grams of the oil in 12 centimeters of a mixture of equal parts of chloroform and glacial acetic acid. Add bromine, drop by drop, until a slight excess is indicated by the color, keeping the solution at about 20 degrees Centigrade. Allow to stand 15 minutes or more and then place the test tube in boiling water. If only vegetable oils are present the solution will become clear, while if fish oils are present the solution remains cloudy or contains a precipitate due to the presence of insoluble bromides."

A positive result was obtained in the initial experiment, the solution remaining cloudy in the boiling water and deposited a good precipitate of insoluble bromides after standing for a brief period of time. The conclusion is that even a minute portion of whale meat cannot be incorporated in beef or pork making sausage when subjected to the searching eye of the chemist.

## The Story Behind the Locked Antlers

OUT of the files of the U. S. Forest Service comes this interesting photograph of a pair of locked deer heads. It appears that these deer fought near Fremont Lake, in the Bridger National Forest, Wyoming, got their horns locked together and were drowned by falling into the lake. These locked antlers were cut out of solid ice by U. S. Foresters.

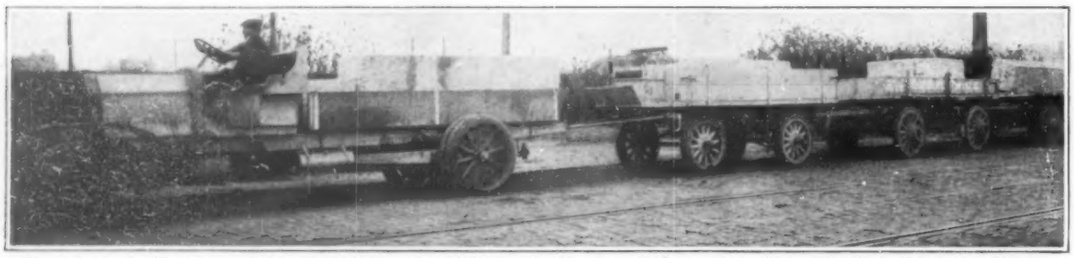


A pair of locked antlers which tell their own story of a fight to the finish

# The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W. PAGÉ, M. S. A. E.

*This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles*



**Trucks and trailers carry a heavy load of stone without exerting too much wear on the road. It is the large wheel-contact area and the distribution of the load that count, not the gross weight of the train or the individual vehicle**

## Truck-Weight Legislation

THE permissible weight of the load on the road should be determined on the basis of width of tires, and not by legislative whims. Routes between large cities or the important commercial and industrial centers serve an enormous tonnage, and the larger the units in which this tonnage is hauled the greater the economy of hauling. These routes are main arteries of traffic, and anything which increases the cost of transportation on them is paid for by all the people, regardless of how far they may be from these main arteries. When it is taken into consideration that 50 per cent increase in the size of the unit hauled makes a 15 per cent decrease in the cost of transportation the matter becomes one of great economic importance with tonnage running up into the millions.

On roads of reasonably good construction the weight is fully taken care of by the 800-pound limit per inch of tire width. For every 800 pounds of increased wheel load, an inch is added to the bearing surface of the tires. With the addition of a trailer the weight of the load can be doubled without doubling the strain on the road. You simply add to the wheel base. The load, while greater, is distributed over more wheels of proportionate tire width. A striking illustration of this is given by our railroads. While heavy rolling stock, such as the big compound engines which are now used on our railroads, are very much heavier than the rolling stock of years ago, the weight per inch of bearing surface has not been greatly increased. This has been met by putting extra bearing surface under the weight. For instance,

(*Continued on page 60*)

## Truck Compressor Tests Natural Gas

TAKING the gasoline out of natural gas by compression is the unique job of the model ¾-ton truck built with special transmission and power take-off for a large oil company of Tulsa, Okla. Comprising a miniature compression plant capable of developing a pressure of 300 pounds, the apparatus on the truck is used to test natural gas as it comes from the wells, with a view to determining its gasoline content. "Casing head gasoline"—the gasoline product resulting when gasoline is taken out of natural gas by compression—is produced at several plants maintained by the oil company using the equipment illustrated; but before gas from new wells is piped to a plant, its gasoline content is determined to make sure that the quantity of gasoline per thousand cubic feet of gas will make it profitable to run it through the plant. Then, too, gas from wells already piped through plants is tested by the truck-compressor unit at frequent intervals as a check on their productivity.

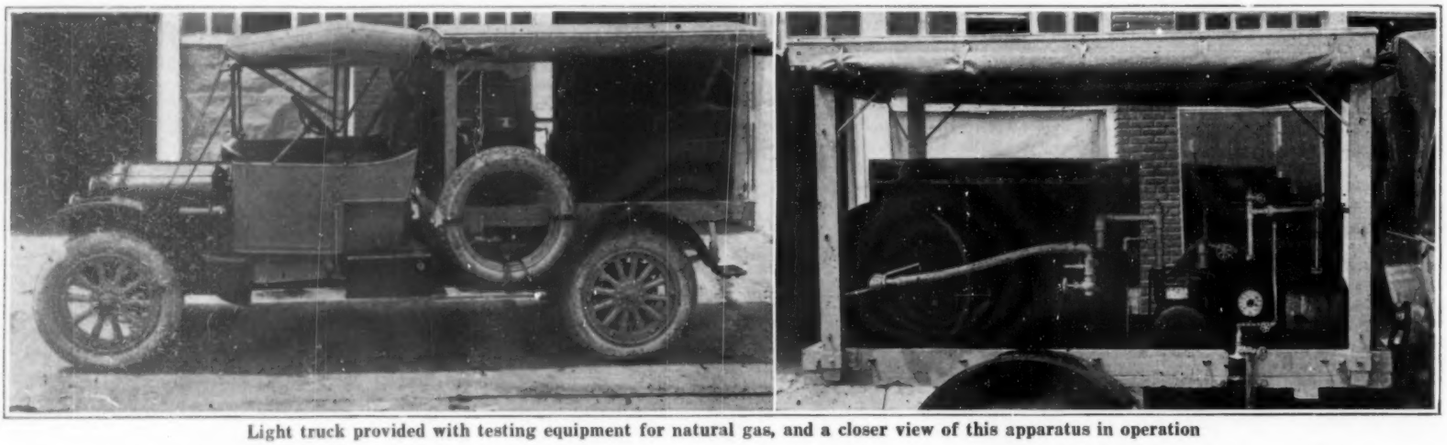
Attached to a reel at the rear of the truck, on the right side, is a rubber hose to reach from the truck to the gas line to be tested. The hose attached to the well, gas passes through it and into a manometer, which indicates the pressure of the gas at the well. Next passing through a meter, the gas is measured. Then it goes through the compressor, passes into a condenser and finally accumulates in a small cylinder which extends below the truck body just forward of the rear spring. A gage glass shows the cubic centimeters of gasoline. From this test, the operator is able to calculate the amount of gasoline which a given quantity of gas will produce. With its special transmission and power take-off, the truck can be driven over the road with power take-off intact, yet not in use. When it is desired to drive the apparatus, the mere shifting of a lever puts the machinery in motion with the full power of the motor applied. Any one of the four gear reductions in the transmission may be used. Thus the operator is given a wide range of speed and power without the necessity of making any mechanical adjustments in the truck when it is changed from road work to driving machinery.

## The Short Haul Problem

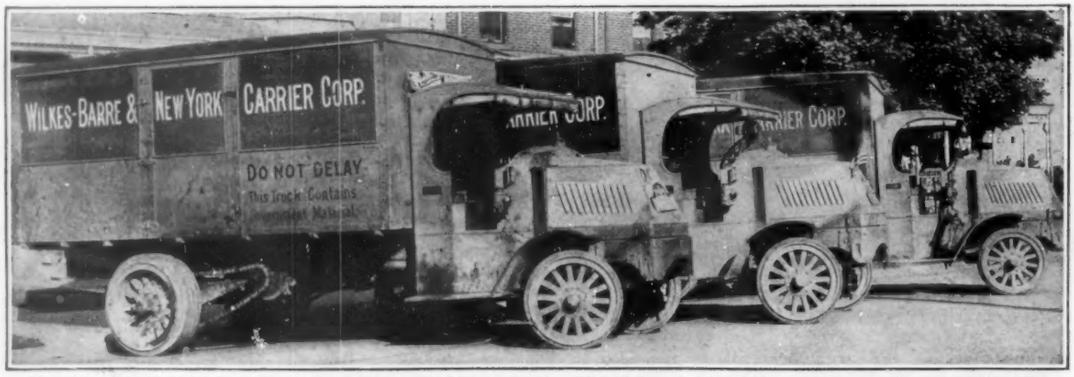
WHEN we look at the picture presented by our railroad situation today we are indeed startled. Our 2,400,000 freight cars carry only about one-half their capacity and move about 25 miles per day per car. Box cars average something over 35 tons capacity, and yet hundreds of thousands of them are carrying less-than-carload freight, and hauling perhaps not more than 5 tons. While it is impossible to give the exact figures we have a record of one investigation of the Cleveland, Cincinnati, Chicago & St. Louis Railway in which it was found that the average less-than-carload loading for a certain six months operation was about 5 tons. Nearly one-half of all the tonnage carried in the Eastern district is coal, according to reports in the *Transportation World*.

Very few records are kept by railroads

(*Continued on page 60*)



**Light truck provided with testing equipment for natural gas, and a closer view of this apparatus in operation**




**Part of a fleet of 7½-ton trucks in regular operation between Wilkesbarre and local Pennsylvania points, and Newark, Paterson and New York, giving a service which the railroad cannot approach, and at less cost**

## Canada's Niagara Development

(*Continued from page 44*)

rock section; but walls are erected on the margins of the rock section and carried up a distance. These are filled in on the rear. At another point, yet farther north, the canal bed is a very flat V. Near the power-house, where the excavation is practically all in rock, the section is substantially a simple rectangle.

In rock excavation, we are mostly familiar with the rock drill and the blast as a means of removing the material. But on this work, the channeling machine has found opportunity for service. The more familiar method is also in use, but channeling seems to be in favor, especially in the upper part of a rock excavation. This machine is much used in certain quarries, doubtless because of the smooth vertical face that it leaves.

Naturally, the steam shovel is greatly in evidence, especially on this canal work, cutting down through the overlying soil or removing spoil in the rock portion. What is claimed as the greatest steam shovel in the world is captain of the Hydroelectric Commission's battery. It is an American-built machine. This fellow is so big that it is thought advantageous to send a smaller shovel ahead as a pilot. The latter makes a preliminary cut, and the giant then tackles the job.

Quite a variety of excavating apparatus has already been in use on this development. The cable-way excavator, the dredge, the steam shovel, the rock drill, and the channeling machine may be cited as among the principal types. The cable-ways work both in the dry on the canal proper and in the wet along the Welland River. Such cable-ways may be very advantageously used where it is possible to arrange parallel tracks along the two sides of the proposed excavation. On these tracks the head and tail towers may be shifted from time to time. The excavating may be carried on, as in the present case, with the aid of the clam-shell type of grab bucket. A heavy cable stretched from tower to tower provides a track on which a carriage may be hauled out and in by means of suitable lines operated by a hoisting engine at the head tower. A close examination of the head towers in the photograph will show that the track consists of four rails—a double track, in fact.

The channeling machine, much used upon this Canadian work, is a device which cuts a deep and narrow vertical slot in the rock. In the quarrying of sandstone and marble, especially where the stone itself is valuable or where it is desired to cut the stone to specified rectangular dimensions, this type of machine is very useful indeed. But channelers have been used in plain engineering enterprises, where a vertical face is required, at least as far back as the time of the construction of the Chicago Drainage Canal. They have been employed on the New York Barge Canal.

A typical channeling machine is an apparatus mounted on small wheels which are adapted to run on a track. A steam boiler on board supplies steam to a vertical cylinder. A piston in the cylinder is made to travel up and down and by means of its rod and a cross-head on the rod to carry up and down a cutting tool. The cutting tool may be of various types. A typical cutting bar is 34 inches long and will cut down into the rock until the slot is 18 inches deep. The bars are used in longer and longer lengths as the cut deepens. A tool of maximum length used on a representative machine will cut to a depth of perhaps 7 feet. A channeling machine operates by making a multitude of percussive blows per minute; 250 per minute is not to be considered unusual. The steel tools used in cutting vary greatly, the variations taking especial account of the particular rock in hand. Thus, the tool may for soft rock consist of as many as five steels each with its cutting

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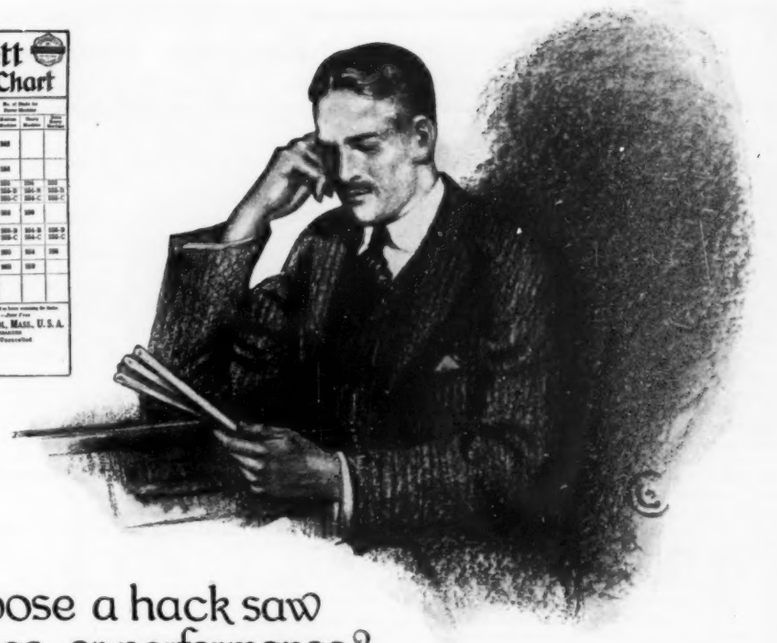

Do you choose a hack saw for appearance - or performance?

Hacksaws all look about alike. Weight, teeth, thickness and finish seem to be similar. The difference is in their performance.

No matter how good the saw may be it's certain that the blade made to cut soft metal won't cut cold rolled stock. There's no such thing as a hacksaw capable of cutting all materials equally well. Fact is, there's only one way to be sure of the right blade and that's by the hacksaw chart.

Picking the right blade for the particular kind or shape of metal is easy if you use Starrett saws according to the Starrett Hacksaw Chart.

We will be pleased to mail you a copy of the chart. Free. Also ask for Catalog No. 22 "B."

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Use Starrett Hack Saws

### Getting the Most Out of the Right Saw

In the small shop, where hand sawing is done and each man owns his own frame, and where but few pieces of different materials are cut from time to time, a change in blades is naturally out of the question for each change in the material. Hence the convenience of a blade like the No. 103 (see Chart on pages 22 and 23), that will in a degree meet all ordinary requirements. But there are few mechanics, who, under even these conditions, cannot at times work to better advantage with a flexible back blade, like the No. 250, which has 18 teeth, or who do not sometimes require a finer tooth blade, like the No. 258, with 32 teeth to the inch, for cutting thin sheet metal. In the end, time will be saved and inconvenience avoided if these saws are kept strained up in separate frames, so that one can be picked up and used instantly. The man who will thus equip himself may generally be relied upon to use with discretion the various blades furnished to him, but wisdom should be exercised in their selection and purchase.

### Each Man Should Have a Chart

Whatever saws are adopted as the standard, a Hack Saw Chart, based on that make of saw, should be established as the basis of selection for the work in hand. Not only should the tool or stockroom from which the saws are issued be provided with these charts, but definite control should be maintained over the delivery of saws of a given number, according to the requirements of the work and the machine, where power saws are used. Each workman, in turn, should have a copy of the chart, perhaps somewhat modified, so that he, too, may know the blade which is best suited for each class of material.

### Should Carry Complete Line

To meet the requirements of different classes of work by the selection of the blade designed for that work, to increase thereby the individual efficiency of each saw and reduce the total number of blades required, it is obvious that a complete line should be carried. It is better to carry and issue exactly the right saw for unusual and intermittent requirements, than to do the work inefficiently for lack of the proper blade.—From *Hack Saws and Their Use*, published by The L. S. Starrett Co., Athol, Mass., for free distribution.

# Recently Patented Inventions

*Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.*

## Of General Interest

TRAFFIC SIGNALING DEVICE.—J. SELLIGMAN, c/o Marion Co., Taylor Bldg., Louisville, Ky. The invention has for its object to provide a device especially adapted for use in cities for controlling traffic at street intersections, wherein the signal is supported by overhead means, permitting the usual standard to be dispensed with, and wherein it may be operated from the center of the street, so that it is not necessary to remove the signal when the rush hours are passed.

TYPEWRITER DESK.—W. F. OLSON, 136 N. 31st St., Omaha, Neb. An object of the invention is to provide a desk having a central channel in which a typewritten supporting platform is movable and adapted to move rearwardly into a housing with a trap door covering the channel and held in closed position when the typewriter is not in use. The desk provides ample smoot surface for the distribution and support of papers when the typewriter is not in use.

NAME PLATE.—A. TOBIAS, Room 914, 41 Union Sq., New York, N. Y. Among the objects of the invention is to provide means for removably supporting letters and other characters of any sort which permits the ready assembling of any name or sign and enables the interchange of letters or characters from time to time as may be desired. A further object is to provide a name plate which will be neat and attractive, and which can be manufactured at an extremely low price.

ADVERTISING DEVICE.—E. F. TREVAIL, Johannesburg, Transvaal, South Africa. This invention has reference to apparatus for exhibiting pictures, particularly such as are used for advertising, in which the exhibited picture is periodically and automatically changed. The apparatus presents a picture for a period, causes it to fade out, and then again brings a picture (usually the next of a series) into view in the reverse manner.

STAIR CARPET RETAINER. — W. W. PHILLIPS, Frankford, Del. Among the objects of this invention is to provide a retainer for stair carpets that will be held in place with more reliability and so will hold the carpet more securely in proper alinement than in any previous device, by reason of certain auxiliary metallic attachments to the main holding device.

REPAIR DEVICE.—M. RODGERS, 26 E. 42nd St., New York, N. Y. The invention relates to an apparatus for repairing flexible tubes in footballs, basket-balls, and other inflatable bodies having internally of their cover what is commonly called a "bladder," said bladder being inflated by means of a flexible tube. It is an object of the invention to provide means by the use of which tubes of the above-mentioned character may be readily applied or repaired.

FOOD PRODUCT.—MARIE BLOCH, 377 Richmond Turnpike, Stapleton, L. I., N. Y. An object of this invention is to provide a palatable and nutritious food product consisting of tomatoes and eggs mixed together to produce a liquid material, flour added to this and thoroughly worked and kneaded to produce a paste or dough of thin strips, and finally cut into pieces of suitable size to be uniformly dried.

COFFEE OR TEA POT.—J. HEINRICHS, 948 Broadway, New York, N. Y. Among the objects of the invention is to provide a simple coffee or tea pot arranged to insure an effective percolation of boiling water through the coffee grounds or tea leaves and without danger of particles passing through the filtrate into the pot, and to permit of the use of a cheap filtering medium, such as filtering paper or the like, which can be readily thrown away after being used.

BOAT.—G. F. BRUNJES, 263 Flatbush Ave., Brooklyn, N. Y. The invention aims more particularly to provide a plan and knock-down construction from which a child may be enabled to build a boat which shall be capable of sailing and shall reproduce as nearly as possible the maneuvers of a full-size sailing boat, having all the essential parts of an actual sailing craft, the construction being adaptable to a full-size boat.

CASHIER PROTECTOR.—E. J. CARROLL, 135 W. 49th St., New York, N. Y. An object of the invention is to provide a shield which is preferably bullet proof and which is normally hid from view, but which may be moved quickly into position to protect the cashier from a burglar in front of his window or desk. The device is brought into operative position by spring pressure and foot release.

ASH SIFTER.—R. MASON, 10 Cowen St., Saratoga Springs, N. Y. This invention has for its object to provide a manually operated ash sifter which facilitates the sifting of the ashes and the ready discharge of the cinders. A further object is to provide an ash sifter which will be practically dustless, which will be convenient to operate, and which can be manufactured and sold at a reasonably low price.

COMBINED WINDOW SCREEN AND VENTILATOR.—C. F. A. CAMMANN, 511 W. 172nd St., New York, N. Y. The invention has for its object to provide a window screen and ventilator more especially designed for use on windows of bathrooms, bedrooms, etc., and arranged to insure the desired ventilation and at the same time prevent outsiders from peeping into the room. Other objects are to insure the admission of fresh air without draft, to prevent rain or snow passing into the room, and to permit the user to conveniently attach the device to a window.

SHOE CLEANING AND IRONING JACK.—H. G. BENDIX and P. J. SPECCE, 195 Lefferts Ave., Brooklyn, N. Y. The invention has particular reference to supports for holding shoes, slippers or the like for the purpose of cleaning or dressing them. Among the objects is to provide a shoe-holding jack that is adapted to directly receive and support a shoe when carried by any conventional last, the means for holding the last and shoe thereon being easily operated.

## Machines and Mechanical Devices

DRYING MACHINE.—J. L. PIERCE, 223 Xneedler Bldg., Manila, Philippine Islands. The invention relates particularly to a machine for drying copra, fish, vegetables and other food products in preparation for shipment and for market. A purpose is to employ a conveyor device within a heating or drying chamber, said conveyor embodying a carrying section and turning means for carrying and turning the material through the drying chamber to be dried.

## Medical Devices

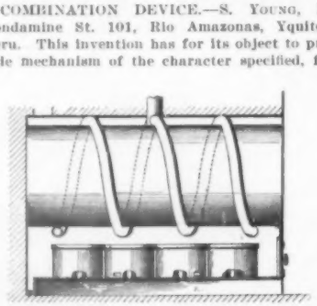
DENTAL TOOL.—F. GONZALEZ, 45 West End Ave., New York, N. Y. The object of the invention is to provide a dental tool in the form of a drilling machine, including in combination with the conventional chuck of a mechanically-driven tool, and operating stem of said chuck, means adapted to be removably associated with the chuck, and to engage the operating stem for permitting a manual rotation of the latter.

## Musical Devices

MUSICAL NOTATION.—F. TAFT, 152 Gates Ave., Monticello, N. J. Among the objects of the invention is to provide a musical notation arranged to enable a person unfamiliar with the usual written or printed score of a musical composition to readily locate the keys and execute the composition on a piano, organ or other keyboard controlled musical instrument without danger of confusing the player.

## Prime Movers and Their Accessories

COMBINATION DEVICE.—S. YOUNG, La Condamine St. 101, Rio Amazonas, Yquitos, Peru. This invention has for its object to provide mechanism of the character specified, for



A SIDE VIEW OF THE DEVICE WITH PARTS IN SECTION

permitting the utilization of fuel in the form of shavings, paper, straw, slack and the like, and for insuring the complete combustion of the same, and for conserving all the heat generated during combustion.

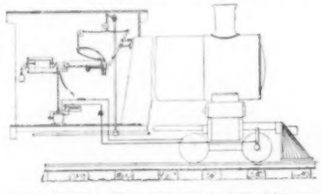
ENGINE.—W. K. EDGAR, 1821 S. 13th St., St. Joseph, Mo. The invention relates more particularly to two-cycle internal combustion engines of a kind adapted for use in aviation and of various other kinds in which simplicity of construction, efficiency in action and compactness in building are desirable factors. The purpose of the invention is to provide for compression of the explosive mixture at the same stroke of the piston which is incidental to the exhaust.

ENGINE.—W. K. EDGAR, St. Joseph, Mo. The invention relates to engines generally, and more particularly to two-cycle internal combustion engines of a kind adapted for use in aviation, and various other ways in which simplicity of construction and compactness in building are desirable factors. The purpose is to simplify the mechanism and to provide for compression of the explosive mixture at the same stroke of the piston which is incidental to the exhaust.

## Railways and Their Accessories

RAILROAD SIGNAL DEVICE.—C. J. CHAMALES, 1246 Hood Ave., Chicago, Ill. Among the objects of the invention is to provide a device which will indicate to the engineer of a train his location, as for instance when the train is approaching a bend in the track which should be taken at a low speed, by operating an audible signal in the cab of the engine. The device is actuated by auxiliary track devices not subject to the difficulties that attend signaling devices operated by making electrical contact with track devices.

TRAIN STOP MECHANISM.—J. MCMANUS, Jet, Okla. An object of the invention is to provide electrically controlled means for preventing train collisions, and which is so constructed as to automatically stop both trains



A VIEW PARTLY IN ELEVATION AND PARTLY IN SECTION

when two trains are on the same block. A further object is to provide means for operating the brakes and closing the throttle of a locomotive, and provide a fusible member burned by the explosion of gasoline which is ignited by a spark caused by the closing of an electric circuit when the two trains are on the same block.

## Pertaining to Recreation

SWING.—A. A. WALL, 1510 Gates Ave., Brooklyn, N. Y. The invention relates to swings accommodating two persons seated opposite each other. The object is to provide a swing arranged to enable the user or users to readily set the swing in motion without requiring undue physical exertion. Another object is to provide a swing which is strong and not liable to get out of order easily.

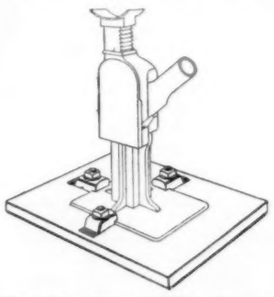
PLEASURE RAILWAY.—F. A. SMITH, 260 W. 125th St., New York, N. Y. The object of the invention is to provide a pleasure railway for use in parks, exhibition grounds and other pleasure resorts, and arranged to provide an exceedingly exhilarating ride for the passengers and amusement for the onlookers. A further object is to provide a long ride within a comparatively small space.

## Pertaining to Vehicles

TANK ATTACHMENT.—C. HERING, 72 Arlington Ave., Mariners Harbor, S. I., N. Y. The invention has particular reference to means for establishing communication between the tank and the full feed conduit. The primary object being to provide means for warning the driver of a motor vehicle before the fuel contained in the tank has been completely exhausted, so that he may reach a filling station before the fuel is entirely used up.

TIRE.—C. W. STRAUSER, 664 E. 166th St., Bronx, N. Y. An object of the invention is to provide a vehicle tire of the single tube type so constructed as to form a closed air chamber without the necessity of employing an inner tube. It is a purpose to provide a single pneumatic tire which will eliminate the usual trouble and expense of repairing the rubber inner tubes so prevalent in ordinary pneumatic tires.

BASE FOR JACKS.—A. E. HUTCHISON and H. KRAH, 372 Monroe St., Brooklyn, N. Y. This invention pertains more particularly to lifting jacks especially employed as an accessory of motor vehicles. In jacks of this



A PERSPECTIVE VIEW, SHOWING THE JACK IN PLACE UPON THE BASE

type difficulty has been experiencel in maintaining the jack in true vertical alinement during the lifting operation. In this device a rigid base is provided, capable of removal, and with securing means which may be adjusted with respect to the base.

RESILIENT TIRE.—D. S. KENNEDY, 457 E. 167th St., Bronx, N. Y. The general object of the invention is to provide a resilient element to be placed in the tire shoe and extend about the same, together with means for expanding the element firmly against the tire at the sides as well as at the tread or for releasing the tension of said spring element for its insertion or removal.

SIGNALING DEVICE.—A. H. BARR, 1822 Poli St., Ventura, Cal. The object of the invention is to provide a device adapted for use on motor vehicles, to indicate to following vehicles, and to those in front, the intentions of the driver as regards turning and stopping, the mechanism being provided at the front and rear of the car, and under control of the driver at the wheel.

POWER DEVICE.—S. BEER, Genl. Delivery, Sacramento, Cal. The invention relates to a device adapted to be driven by the drive wheels of an automobile, an object being to provide a device which can be quickly assembled and taken apart and can thus be easily transported from place to place. A further object is to provide a device which is so constructed that a car can be conveniently run into operative position.

## Designs

DESIGN FOR LACE.—H. BAECHTOLD, 1270 Broadway, New York, N. Y.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—D. C. FRANK, 28th St. and 4th Ave., New York, N. Y.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—G. GOULD, McKenney, Texas.

DESIGN FOR A CALENDAR FRONT.—A. J. MCDADE, 63 Park Row, World Bldg., New York, N. Y.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—H. T. MENDELSOHN, 40 W. 25th St., New York, N. Y. The invention has been granted patents of two designs of a similar nature.

DESIGN FOR A PLAQUE OR PANEL.—M. SHAPIRO, c/o Metropolis Metal Spinning Co., Inc., 247 Center St., New York, N. Y.

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## Canada's Niagara Development

(*Continued from page 55*)

edge and all held securely in the crosshead. Some of the edges may make a transverse cut, while others in between make diagonal cuts, the whole combined cut being a kind of zig-zag. The tool may consist thus of a gang of steels; but it may also consist of a single steel with a Z-form of cutting edge.

Of course, the excavation is not comparable to that at the Panama Canal. At the same time, the amount of rock and earth that must be removed is very considerable. On the section between the Niagara River and the control works, the earth excavation in the Welland River bed totals about 3,500,000 cubic yards. A large part of this work is wet excavation. A dipper dredge has been operating in the Welland River bed, depositing its spoil into scows. These are being dumped out in the Niagara River. A cable-way is also a means of excavating.

Several considerable concrete bridges are included in the general undertaking. One carries the Wabash Railway across the canal. It is finished; so also are one or two others.

The power-house is at the foot of a steep incline. The initial equipment is to consist of two big 55,000-horsepower turbines and their corresponding electric generators. The forebay on the ledge above reaches back along the canal for a distance of 1,000 feet. That is, the canal is widened to form this little lake, which is 300 feet wide at its intake end. It delivers water to the penstocks, which are big steel pipes 14 feet in diameter and some 450 feet long. Four main penstocks and one exciter penstock constitute the initial equipment for serving the power-house. Taking the head at the full amount of 305 feet, the pressure, neglecting friction, at the bottom of the penstocks will be about 132 pounds per square inch. There is, however, nothing remarkable in this pressure considered alone; but the combination with big diameter means a large mass of water confined under considerable pressure.

## Fifth Avenue's Traffic Tower

(*Continued from page 45*)

his *locus operandi* in the tower itself. This not alone puts his signals where all his subordinates can see them, but it at the same time gives him an unrestricted view of the entire length of the avenue. Ordinarily the change from north-south to east-west traffic is made on a fixed time-table, allowing from 40 seconds to two minutes for each according to the time of day, etc.; but it frequently happens that special conditions somewhere along the avenue make it advisable to modify this schedule. Just as an instance, if there were a minor wreck on the avenue itself which it was plain could be cleared away in five minutes, it might well be the best procedure to close traffic on the avenue at the point affected for this period. Without the signal tower and the central administration of traffic, this would involve a frightful congestion in the immediate vicinity of the accident; with it the entire avenue could be kept closed for the time necessary and the congestion distributed to a surprising degree.

The pedestrian traffic at big crossings like that of Fifth Avenue and 42nd Street is always a nuisance and a problem. The man on foot cannot, apparently, be made to believe that traffic regulations apply to him. He visualizes them as for the vehicle alone, and feels that he is free to cross wherever and whenever he can, dodging about among the cars until he attains his objective at the far curb. It was recognized from the start that the success of the whole plan of central regulation would depend, as much as upon any other one factor, upon the degree to which the pedestrian could be prevented from slowing up the vehicular movement in this way at the Big Corner, the heart of the system. So here we find always four

*"The child is an angel, dependent on man."*—COUNT DE MAISTRE

# Call of the Children

It is, indeed, true that the children, even more than the mother, is dependent on the father, who must recognize this by making due provision for the little ones in case he is called away.

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or more officers on the street level, one or more on each of the four corners; and after a little preliminary skirmishing during the first week or two, the walkers have been educated to the fact that here is one place in the world where they move with the traffic, and stop when it stops.

The success of this block signal plan has been pronounced from the start. Accidents are fewer—indeed, there has not been one of any account in the entire nine months. The flow of traffic is much smoother and more speedy; instead of a stop at practically every corner, with a few stops in the middle of the block thrown in for good measure, one often drives five or six blocks on the avenue before being halted by the red light. Indeed, tests inaugurated by Deputy Police Commissioner Harriss, in charge of the Traffic Division, who is responsible for the installation to the point of having paid out of his own funds for the first tower, show that where the average time for a trip from 34th to 59th Streets under the old system was 42 minutes, it is now only nine minutes. The distance, it may be said, is about a mile and a quarter.

## Sunshine and Balloon Silk

*(Continued from page 45)*

which, in turn, was affixed to the declination axis. The telescope tube supporting the collimating lens could be rotated a small amount and clamped, thus permitting minor adjustments of the spectrum upon the thermopile receiver. A black flannel cloth was laid over the spectrograph in barring stray light while observing the sun. A specially constructed thermopile was employed in the unit for taking solar-radiation-intensity measurements, which consisted of nine couples of bismuth silver, with receivers 1.1 by 3 millimeters; the dimensions of the entire receiver being 3 by 9.5 millimeters. The bismuth wire, 0.1 millimeter in diameter, was flattened as a method of obtaining adequate contact with the receivers. Thereby the time element in attaining thermal equilibrium was reduced, consuming only 10 or 12 seconds.

The height of the spectrometer slit was 3 millimeters, and although the spectrum was of only an equal height, the intensity was adequate for making accurate measurements. Such a condition was partly attributable to the fact that the length of the spectrum, falling upon the thermopile, was 8 millimeters, sufficient to intercept the whole of the visible, and also the whole of the infra-red spectrum, each in one setting, and the ultra-violet spectrum in two settings. The electric current generated by the thermopile, on exposure to radiation, was measured by a sensitive galvanometer.

The data were obtained primarily for the purpose of ascertaining the different components relative to that of the quartz-mercury arc lamp. Solar radiation is variable as can be assumed from these tests. A low-hanging haze, or smoke, on a September day rendered invisible the Soldiers' Home Building three miles away; later on the same day the sky cleared and the ultra-violet light doubled its intensity. Subsequent to a rainy period of several days' duration, when the sky was extremely clear, the ultra-violet component was 2 per cent of the total radiation intensity. Experiments during the early morning hours showed that in consequence of increased scattering of light the ultra-violet component radiation intensity is only approximately one-half that which obtains at noon-day. The reverse condition prevails with respect to infra-red component, which is greatest in the morning and evening, and is a minimum at noon. This is explained by the accepted theory of the scattering of light of short wave lengths. Coupled with the invention of this new government instrument for studying the sun and the variation in the intensity of the ultra-violet radiation, valuable meteorological data may be obtained from a comprehensive investigation of the subject.


# PATENTS

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## The Romance of Invention—XIX

(*Continued from page 46*)

or armies, or battleships," he contends, "it is necessary to consider only their relative abilities to do damage to each other and defend each himself against the other. No reference to extraneous force can be permitted in a truly fair comparison, because if extraneous force be admitted as an argument on one side, it is necessarily permissible to have the same admission on the other side. Thus, in considering whether or not the battleship can defend itself against the torpedo plane, it is not admissible to say 'the battleship can have a guard of sea-planes, which will arise to meet the torpedo plane in the air and demolish it before it can attack'; because the proponent of the torpedo plane may equally provide the mother ship of the torpedo plane with a flock of fighting planes to arise and go forth with the torpedo plane to give battle to the planes which come from the battleship. We have then staged an aerial battle, the result of which may fall to either contender; and meanwhile we are where we were in the first place; there are a torpedo plane and a battleship left over to fight it out, while the defenders of the one and protectors of the other do their parts in the air.

"It is not easily seen how a battleship can protect itself from the attack of a torpedo plane. The battleship is protected from ordinary torpedo attack by destroyers, smoke screens, and similar fighting or protecting devices, all of the same class of speed and all on the same location-plane in space, as the thing to be protected. A destroyer may be twice as fast as a battleship but not ten or fifteen times as fast. A destroyer cannot get up in the air and fly. And a destroyer is a target for a naval gun.

"A torpedo plane may attack without being noted until too late. At a high altitude it is invisible and inaudible. It can see, but cannot be seen. It can descend so swiftly that it cannot be hit, even if seen. It can come within close range of the battleship, launch its torpedo and swoop upward again so rapidly that it is practically safe. Even if it were not safe, what is one man, one inexpensive plane against the loss of a great ship?"

In other words, Admiral Fiske believes that the strong and basic patent given him in 1912 is for an invention not only of a new device for waging war, but of a new system of warfare, and that more than one instance in the late war shows that a torpedo plane may destroy a ship and escape, as a Turkish vessel was torpedoed by a British aviator launching a torpedo from his air craft, and the British ship "Gena" was sunk by a torpedo discharged by a German plane near Suffolk, England.

A great distinction exists between bomb-dropping and torpedo planing, which must be well visualized before any argument is undertaken as to the value of the torpedo plane in wars which may come. The bomb dropper, to be at all effective, must actually hit the thing on which he drops his deadly egg or fall exceedingly close. In the case of a battleship, this is a rather narrow target; and in spite of the accuracy of the aiming device, there is always the possibility of error in determining the speed and altitude the absolute vertical and the consequent correct aim of the projectile. With the torpedo plane the chances of a miss are very small. The range may be as short as the nerve and skill of the aviator make possible. Moreover, the torpedo when it strikes, strikes below the water line, in the most vulnerable part of the ship. Again, the bomber must be, if not directly overhead, at least approximately overhead where he is exposed to anti-aircraft guns. He can be driven off by airplane guards also much more easily than the torpedo plane, because the latter can attack from any point of the compass and from any altitude; from positions so close to the water, for instance, that a fighting airplane cannot get under him, where he is the most vulnerable. Admiral Fiske has recently made an invention which he thinks will aid the torpedo plane very greatly, but its character is not yet known, except to a very few.

It is not the function of the stories in this series on great living inventors and scientists to engage in controversies, take sides, or enter into argument with the Governmental powers that be, regarding inventions and inventors. But it was noted in these pages that the Lewis machine gun received its accolade in France and Flanders after America had rejected it; and it is stating only the facts to admit that America was offered the torpedo plane by its inventor, that institutes, associations, officers, scientists and manufacturers endorsed the idea and the invention to the Navy Department, only to have it rejected; and that at the time of the Armistice, Great Britain had perfected Admiral Fiske's original idea to the extent of having a great number of such torpedo planes ready for action, and that the surrendered German fleet was met and escorted to its disgraceful end by, among other things, a ship with torpedo planes aboard, which at the slightest hint of treachery would have proven once and for all that even mighty ships of steel cannot withstand torpedo attacks from the air.

It would be difficult if not impossible in a story of this length even to epitomize Admiral Fiske's inventions for the Navy which is so much his own work. When a man lives in the Navy from boyhood to retirement, and when such a man is naturally an inventor and has in addition perfected himself in certain branches of science with the one idea of aiding the Navy, his contributions come too fast and in too many numbers adequately to catalog. While his most important ideas have here briefly been set forth, it would be entirely wrong to fail to mention the great effect Admiral Fiske's work has had on the electrical equipment of fighting ships of all sorts and to chronicle that range finders, gun sights, direction finders, systems of fire control and a hundred other ideas regarding the actual aiming and firing of guns (the end and aim of a fighting ship) have come from him in great numbers. An invention which he made in 1897 and on which he secured the basic patent in 1900, is now about to come into use. This is his system of "Wireless Control of Moving Vehicles," which John Hays Hammond has done so much to develop, and which our navy has successfully used for directing the movements of battleships intended as targets.

Admiral Fiske has often been prevented in the development of an original idea, either by the exigencies of the service or the press of work attendant on the perfecting of even more important inventions, and has seen original conceptions of his own taken up and perfected by others who thus received the credit, which he would be the last to say was not their due, for working out to the point of practicality, an idea of which he was the real originator. But Admiral Fiske has the undoubted satisfaction of knowing that more than sixty patents of his have done more than sixty much needed things for the Navy and that in spite of red tape, official discouragement and sometimes that open hostility to any change which pervades huge governmental machines, his work and labors have aided in making the United States battleship second to none, and that his labors, his patents, his devices and ideas have had much to do with making that ancient contention, that United States ships were but copies of ships of other navies, an outworn phrase heard now only in the mouths of the envious.

It is pleasant to find in Rear Admiral Fiske's book, "From Midshipman to Rear Admiral," a happy reference to this journal, and to learn that at one time, when


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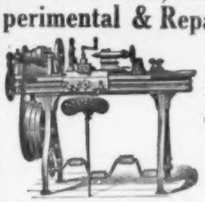
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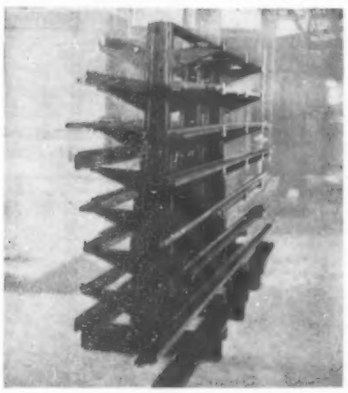

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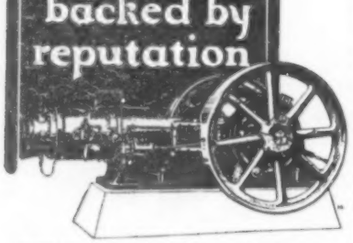


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discouragement had caused him seriously to consider dropping a naval career for one of possibly larger financial reward in business, he desired to go to work for the sheet which now devotes this space to sketching his inventive activities. As an editor of the SCIENTIFIC AMERICAN, no one who knows him doubts that he would have carried forward the torch of scientific ideals which this paper has always striven to keep brightly lighted; but in the interest of our first line of defence it is surely a matter of congratulation that one of the most prolific inventors of modern times should have persevered in his chosen profession, rather than left it for the more quiet haven of an editorial office.

## Insect Ravages in Our Forests

(*Continued from page 48*)

thereby saved more than $100,000.

"The presence of the southern pine beetle in dangerous or destructive numbers is plainly indicated by patches of dying and dead pine which show no evidence of injury by fire or other destructive agencies," says the Bureau of Entomology in describing insect depredations in the South. Observations in the Southern States are responsible for an authoritative statement that if all the pine killed for 20 years by the beetle was living today, its stumpage value would be appraised from $10,000,000 to $20,000,000. Studies of insect-wrought havoc in the South Atlantic and Gulf States for a period of three years indicate that at least $2,000,000 worth of pine has been squandered by natural enemies of the forests. Briefly stated, the method for arresting the invasion of the southern pine beetle is to locate the infested trees during November, December, January, February and March and destroy the overwintering broods in the bark of the main trunks. This may be accomplished by a number of ways: Remove and burn the infested barks from the trunks of standing trees or after they have been cut down, place the infested portions of the trunks in water or convert the trunks of the infested trees into cordwood and use the wood for fuel before the beetle leaves the bark.

That insects are constantly menacing the lumber industry can be illustrated by examples of visitations other than those so destructive to Douglas fir or balsam and the southern pine. The value of black or yellow locust has recently been accentuated as a derivative for locust pins or tree-nails in the construction of wooden ships. Growth of the trees, other than scattering specimens in forests, farmers' woodlots and abandoned fields, has been futile as a commercial enterprise because of the depredations of the locust borer. The handicap under which commercial operations labored inspired a specialist in forest entomology to make an investigation, his conclusions being significant:

"It appears practically certain that plantations of this tree can be protected successfully from the borer and grown profitably on a commercial scale if the locusts are planted in thick stands or mixed with other trees so as to produce a densely shaded condition and natural pruning during the first ten to fifteen years of growth." The Pennsylvania Railroad planted 42 plantations, comprising 2,000 acres, embracing the culture of over 1,000,000 trees. Some of these locust plantations are in prime condition while others have completely succumbed to the attacks of the locust borer. Here are some reasons advanced by a Government investigator for immunity to insect attacks: For some inexplicable cause trunks of trees attaining to 5 inches in diameter and over rarely contain borers, sufficient shade during the period of growth is a deterrent to borer infestation, and once the pests have intrenched themselves in new growth an arsenical spray is a death-dealing application.

As previously stated, the depredations of insects are not so spectacular as a forest fire; nor are the earmarks of destructiveness so pronounced. Yet the evidence is convincing—a clump of yellow-top or red-top trees in the distance, closer scrutiny and you observe pitch tubes and boring dust on and around the trunks of living trees—the signals are unmistakable for action in forestalling widespread destruction. Combating a forest fire is a hurry-up job; beetle control affords a leeway of from six to ten months in which to utilize or otherwise efface the affected timber in doing away with the broods of beetle in the bark. The beetles of the genus Dendroctonus are identified in the adult stage by their cylindrical, somewhat elongate to stout bodies, broad and prominent heads, nearly round to oblong, oval and transversely placed eyes behind the base of each antenna. Among the Dendroctonus beetles there are isolated species which are attracted to weakened and dying trees and to the stumps, logs and tops of recently felled living trees. Hence, the trap-tree method of control where trees are cut as a decoy for the insects to breed therein before their destruction.

Among the requisites prescribed by the Bureau of Entomology in combating bark beetles are: Give prompt attention to evidence of an outbreak, as indicated by an overshadowing percentage of yellow or red topped dying trees, and especially when these signs occur in groups of ten trees or larger areas; obtain information as to the identity of the species creating the trouble, and adopt the most effective control method for destroying 75 per cent or more of the insects in the infested trees. Here are some of the formulas of control: Utilize the infested timber and burn the slabs during the period in which the broods of the beetles are in the immature stages or before the developed broods emerge from the bark; or—fell the infested trees and remove the bark from the main trunk and burn the bark if necessary; remove the infested bark from the standing timber and burn the bark when necessary; immerse the unbarked logs in ponds, lakes or streams, where the bark will remain soaked long enough to kill the insects; or remove the unbarked logs or products to a locality where there are no trees liable to attack within a radius of 20 miles or more. Continued scientific research, augmented by an arousal of public appreciation as to the importance of organized warfare on the tiny foes of the forests, should ultimately minimize the enormous forfeiture of $70,000,000 to the alarming depletion of the Nation's timber supply. Any National forest policy which would strengthen the arms of the entomologist in protecting the forests from foes within is characterized by that same forehanded wisdom that builds a lookout station on the pinnacle of a mountain peak and details a guardian to safeguard Nature's bounties.

## The United States Light Cruiser "Omaha"

(*Continued from page 49*)

Navy, is the adoption of the British tripod mast, at the head of which is located a closed director-fire position, from which the fire of the battery of twelve six-inch guns will be controlled. A secondary battery will consist of two three-inch, 50-caliber aircraft guns and two three-pounder saluting guns. The vessels will also carry two 21-inch twin torpedo tubes which will be located on either beam on the main deck between the aftermast funnel and the main fast. The boats will be liberally supplied with searchlights and range finders.

Altogether these vessels should prove to be very serviceable craft. The pity of it is that they are not in commission today. The only representatives of the light cruiser or scout class which we possess at present are those relatively slow and out-of-date scouts the "Birmingham," "Chester" and "Salem," the keels of which were laid fifteen years ago.

## Truck-Weight Legislation

(*Continued from page 54*)

the big engines have 16 driving-wheels; the early engines had only four.

It would have been as sensible fifty years ago to have prohibited the use of locomotives larger than the little four-wheeled drivers, as it would be today to limit the weight of the motor truck on any other basis than tire width, and the number of wheels under the weight, which in the case of our large locomotives gives several hundred per cent greater hauling capacity with probably only one hundred per cent greater weight of rail. Without the development of the large locomotive and the increased size of railroad cars, freight rates would probably be double or triple what they are now and they seem plenty high enough at the present time to those who pay them. If we set an artificial limit on motor-truck weight we are handicapping what is fast becoming an important means of transportation, adding to the cost of every article of food or clothing we use, and placing a generally greater economic burden on the country. We must build the roads to carry the loads, not limit progress by using highways of inadequate construction when better and more resistant paving should be provided to keep pace with the more efficient forms of motor transports.

## The Short Haul Problem

(*Continued from page 54*)

as to their terminal and short-haul costs. From the best figures obtainable it seems that their terminal charges amount to about 10 cents per 100 pounds at each end of the line. Terminal charges include the switching and placing of the car, loading and unloading, the clerical work necessary to take care of this work, and general overhead charges to be proportioned to these operations. An authority has said that it costs about $35 to deliver a car in Manhattan or Brooklyn after it reaches the Jersey Terminal, while in Chicago it costs something like $10.35 and in a small city like Binghamton, N. Y., $1.80. Against the 20-cent terminal charges the average cost of the line haul is less than one cent. The big charges are for loading, unloading and handling; and unless a shipment goes a sufficient distance to warrant all this labor, the practice is not economical.

Fifteen cents per hundredweight is a fair charge for cartage at each end of the line when considering less-than-carload shipments. Adding to this the terminal charges mentioned, we find that the transportation cost of this shipment, exclusive of the cost of the line haul, from door to door is 50 cents. From this it is reasonable to infer that for any locality to which the motor truck can deliver for 50 cents per 100 pounds or less it would be more economical to ship by motor truck. This does not take into consideration the service meaning of a delivery in a few hours which on the railroad might take two weeks.

It would seem reasonable to suppose that on all distances under 50 miles the railroad is losing money. Rather than tax the long haul to make up for short-haul loss, it would seem more practical to do away with the business which is carried at a loss. The thousands of cars, containing package freight, which come into stations to be broken up and redistributed to other roads, block the entire traffic stream and tie up through freight because an arrangement has not been made to transfer these small-lot shipments immediately by vehicles from the incoming cars to the railroad that is to carry them out. This delay holds up thousands of cars every week.

The answer to this problem is to increase the use of motor trucks for all short haul work and thus release many freight cars that are now working to less than half capacity for the work they can do to the best advantage.

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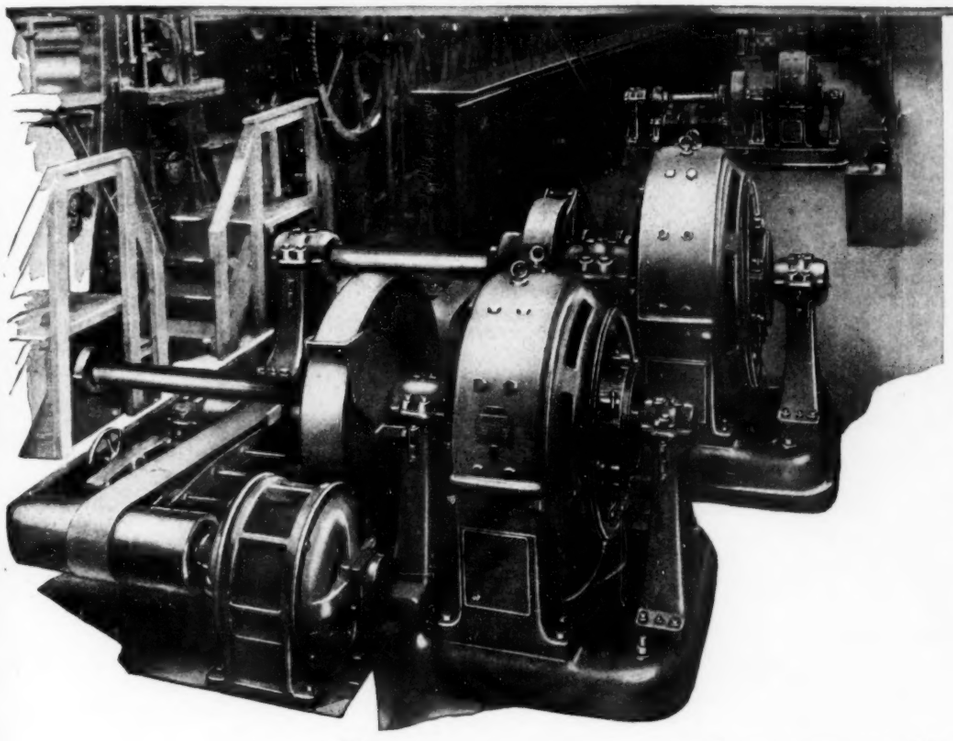

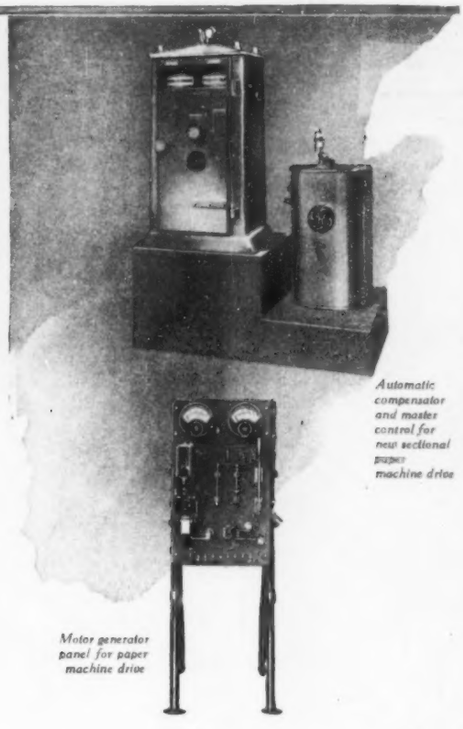

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